Allen-Bradley

PowerFlex®

700S High Performance AC Drive and 700H Adjustable Frequency AC Drive

Frame 11
315-400KW / 400V
500-600HP / 480V
500-600HP / 600V
450-560KW / 690V

Hardware Service Manual

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at **www.rockwellautomation.com/literature**) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary we use notes to make you aware of safety considerations.

WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

Important: Identifies information that is critical for successful application and understanding of the product.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you:

- identify a hazard
- avoid the hazard
- recognize the consequences

Shock Hazard labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.

Burn Hazard labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be at dangerous temperatures.

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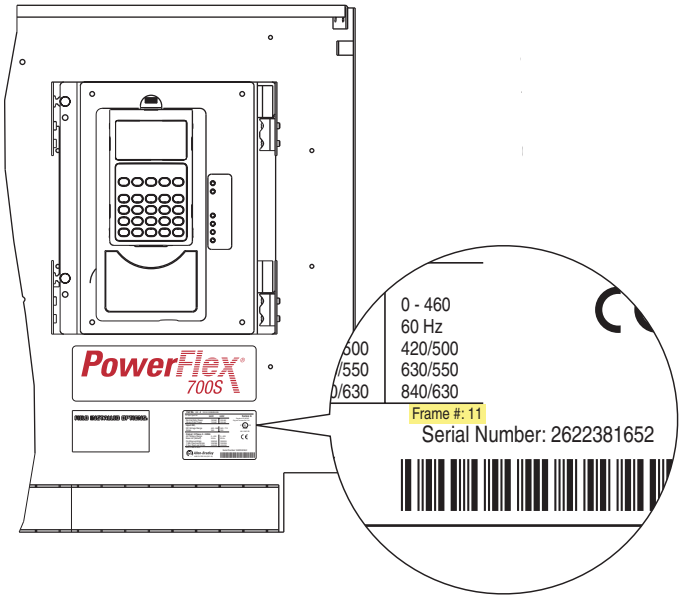
Overview

Who Should Use this Manual?

This manual is intended for qualified service personnel responsible for troubleshooting and repairing high power PowerFlex 700S and 700H AC Drives. You should have previous experience with, and basic understanding of, electrical terminology, procedures, required troubleshooting equipment, equipment protection procedures and methods, and safety precautions.

What is in this Manual

This manual contains hardware service information for Frame 11 PowerFlex 700S and 700H drives only. Verify that you are working on a Frame 11 drive by checking the data nameplate on the Control Frame. The frame number is printed just above the serial number.



What is Not in this Manual

This manual does not contain in depth fault information for troubleshooting. Fault information is available in publications 20C-PM001, *Programming Manual - PowerFlex 700H Adjustable Frequency AC Drive*, PFLEX-IN006, *Installation Instructions - PowerFlex 700S and 700H Adjustable Frequency AC Drive*, and 20D-UM006, *User Manual - PowerFlex 700S High Performance AC Drive Phase II Control*.

Reference Materials

Allen-Bradley publications are available on the internet at: www.rockwellautomation.com/literature.

The following publications provide general drive information.

Title	Publication
Wiring and Grounding Guide, (PWM) AC Drives	DRIVES-IN001...
Safety Guidelines for the Application, Installation and Maintenance of Solid State Control	SGI-1.1
A Global Reference Guide for Reading Schematic Diagrams	0100-2.10
Guarding Against Electrostatic Damage	8000-4.5.2

The following publications provide specific PowerFlex drive information.

Title	Publication
Programming Manual - PowerFlex 700H AC Drive	20C-PM001...
User Manual - PowerFlex 700S High Performance Drive Phase II Control	20D-UM006...
Installation Instructions - Hi-Resolution Feedback Option Card for PowerFlex 700S Drives	20D-IN001...
Installation Instructions - Multi Device Interface Option for PowerFlex 700S Drives	20D-IN004...
Installation Instructions - Main Control Board PowerFlex 700S Drives	20D-IN005...
Installation Instructions - Control Assembly Cover for PowerFlex 700S Drives	20D-IN006...
Installation Instructions - PowerFlex 700S /700H High Power Maintenance Stand	20D-IN014...
Installation Instructions - PowerFlex 700S and 700H Drives	PFLEX-IN006...
Reference Manual - PowerFlex 700S Adjustable Frequency Drive Phase II Control	PFLEX-RM003...

The following publications provide information that is necessary when applying the DriveLogix™ Controller.

Title	Publication
User Manual - DriveLogix System	20D-UM002...
Installation Instructions - DriveLogix Controller	20D-IN002...
Installation Instructions - Memory Expansion for DriveLogix Controller	20D-IN007...
ControlNet Daughtercard Installation Instructions	1788-IN002...
ControlNet Daughtercard Installation Instructions	1788-IN005...

Understanding Manual Conventions

Terms

The following words are used throughout the manual to describe an action:

Word	Meaning
Can	Possible, able to do something
Cannot	Not possible, not able to do something
May	Permitted, allowed
Must	Unavoidable, you must do this
Shall	Required and necessary
Should	Recommended
Should Not	Not recommended

Cross References

"Figure 2.2 on page 2-6" is a cross reference to figure 2.2 on page 5 of Chapter 2.

"Figure C.1 on page C-2" is a cross reference to figure C.1 on page 2 of Appendix C.

Additional Support Available on Internet

Additional troubleshooting information and software tools are available on the Allen-Bradley Drives Support Website (*http://www.ab.com/support/abdrives/*).

General Precautions

Class 1 LED Product

ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into module ports or fiber-optic cable connectors.

ATTENTION: The sheet metal cover and mounting screws on the ASIC Board located on the power structure are energized at (-) DC bus potential high voltage. Risk of electrical shock, injury, or death exists if someone comes into contact with the assembly.

ATTENTION: This drive contains **ESD** (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.

ATTENTION: An incorrectly applied or installed drive can result in component damage or a reduction in product life. Wiring or application errors, such as, undersizing the motor, incorrect or inadequate AC supply, or excessive ambient temperatures may result in malfunction of the system.

ATTENTION: Only **qualified personnel** familiar with high power PowerFlex 700S and 700H Drives and associated machinery should plan or implement the installation, start-up and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the DC+ & DC- terminals. The voltage must be zero.

ATTENTION: Potentially fatal voltages may result from improper usage of an oscilloscope and other test equipment. The oscilloscope chassis may be at a potentially fatal voltage if not properly grounded. If an oscilloscope is used to measure high voltage waveforms, use only a dual channel oscilloscope in the differential mode with X 100 probes. It is recommended that the oscilloscope be used in the A minus B Quasi-differential mode with the oscilloscope chassis correctly grounded to an earth ground.

Troubleshooting and Error Codes

ATTENTION: To avoid an electric shock hazard, ensure that all power to the drive has been removed before performing the following.

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the DC+ & DC- terminals. The voltage must be zero.

ATTENTION: HOT surfaces can cause severe burns. **Do not** touch the heatsink surface during operation of the drive. After disconnecting power allow time for cooling.

ATTENTION: This drive contains **ESD** (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.

Creating Fault Reports

Complete fault reports are critical for analysis and repair of modules returned to the factory.

At a minimum, perform and record the following:

- Record the contents of the fault queue (faults and times of occurrence)
- Make record of any burn marks on the rectifying module, DC-capacitors, inverter bridge, charging resistors, balancing/precharging resistors, printed circuit boards, bus bars, cabling and fiber-optic cabling
- Make record of any liquid and condensation marks on printed circuit boards, components and mechanical parts
- Make record of the amount of dust and other additional particles on drive and drive components
- Make record of any mechanical damage to the drive and drive components
- Record the size and type of main fuses
- Record any other important marks and damage

Addressing 700S Hardware Faults

Fault	No.	Description	Action *(if appropriate)*
HiHp In PhaseLs	65	AC Input Phase Loss - AC voltage is not present on one or two input phases.	1. Check for voltage on each input phase. 2. Check the status of each external input fuse.
HiHp Bus Com Dly	66	Bus Communication Time Delay - the processor has not received proper periodic feedback information.	Check fiber-optic connections between the Power Interface Circuit Board and Voltage Feedback Circuit Board.
HiHp Bus Link LS	67	Bus Communication Link Loss - bus communication between the Power Interface Circuit Board and Voltage Feedback Circuit Board has halted.	Check fiber-optic connections between the Power Interface Circuit Board and Voltage Feedback Circuit Board.
HiHp Bus CRC Er	68	Bus Communication CRC Error - too many Cycling Ring Checksum (CRC) errors have occurred in the communication bus. A fast power cycle may cause the 700S Main Control Board to attempt to communicate with the ASIC Board before the ASIC Board is energized.	Check fiber-optic connections between the Power Interface Circuit Board and Voltage Feedback Circuit Board. Wait five minutes before re-energizing the drive.
HiHp Bus WtchDog	69	Bus Communication Watchdog Error - communication has halted in the communication bus, causing the watch dog timer to expire.	1. Check fiber-optic connections between the Power Interface Circuit Board and Voltage Feedback Circuit Board. 2. Check connections between the Main Control Board and the Power Interface Circuit Board. 3. Replace the Voltage Feedback Circuit Board. 4. Replace the Power Interface Circuit Board. 5. Replace the Main Control Board.
HiHp Fan Fdbk Ls	70	Fan Feedback Loss - a fan feedback signal has been lost.	1. Check the main cooling fan. 2. Check the Main Control Board cooling fan.

Fault	No.	Description	Action *(if appropriate)*
HiHp Drv OvrLoad	71	Drive Overload - the circuit board on the Power module has detected an overload.	Measure output current of the drive. If the level is ever greater than the maximum drive rated output current level reduce the load. If the levels are always well below the drive rated levels, then replace the power module.
HiHp PwrBd PrcEr	72	Power Board Processor Error - a microprocessor on the Power Board has detected a communication error.	1. Check fiber-optic connections between the Power Interface Circuit Board and Voltage Feedback Circuit Board. 2. Check connections between the Main Control Board and the Power Interface Circuit Board. 3. Replace the Voltage Feedback Circuit Board 4. Replace the Power Interface Circuit Board. 5. Replace the Main Control Board.
HiHp PrChrg Cntc	73	Precharge Contactor Fault - proper contactor feedback has not occurred. The precharge contactor has probably failed to pick up or the feedback signal has failed. This fault only applies to DC input drives.	• Check precharge circuit wiring. • Check for loose connections on X50 terminal block and/or the X9 and X15 connectors on the ASIC Board.
HiHp PwrEE Error	74	Power EEPROM Error - the rating of the drive and data in the Power EEPROM on the Power Board do not match.	Replace output power module or program a new power board.
HiHP PwrBd OTemp	75	Power Board Over-Temperature - temperature of the Power Board on has exceeded 85° C.	Check the main cooling fan and fan power supply, replace if necessary.

Addressing 700H Hardware Faults

Name	No.	Description	Action *(if appropriate)*
Auxiliary In	2	Auxiliary input interlock is open.	Check remote wiring.
Power Loss	3	DC bus voltage remained below [Power Loss Volts] for longer than [Power Loss Time]. Enable/Disable with [Fault Config 1]. For more information refer to publication 20C-PM001, *Programming Manual - PowerFlex 700H*.	Monitor the incoming AC line for low voltage or line power interruption.
UnderVoltage	4	DC bus voltage fell below the minimum value of 333V for 400/480V drives and 461V for 600/ 690V drives. Enable/Disable with [Fault Config 1]. For more information refer to publication 20C-PM001, *Programming Manual - PowerFlex 700H*.	Monitor the incoming AC line for low voltage or power interruption.

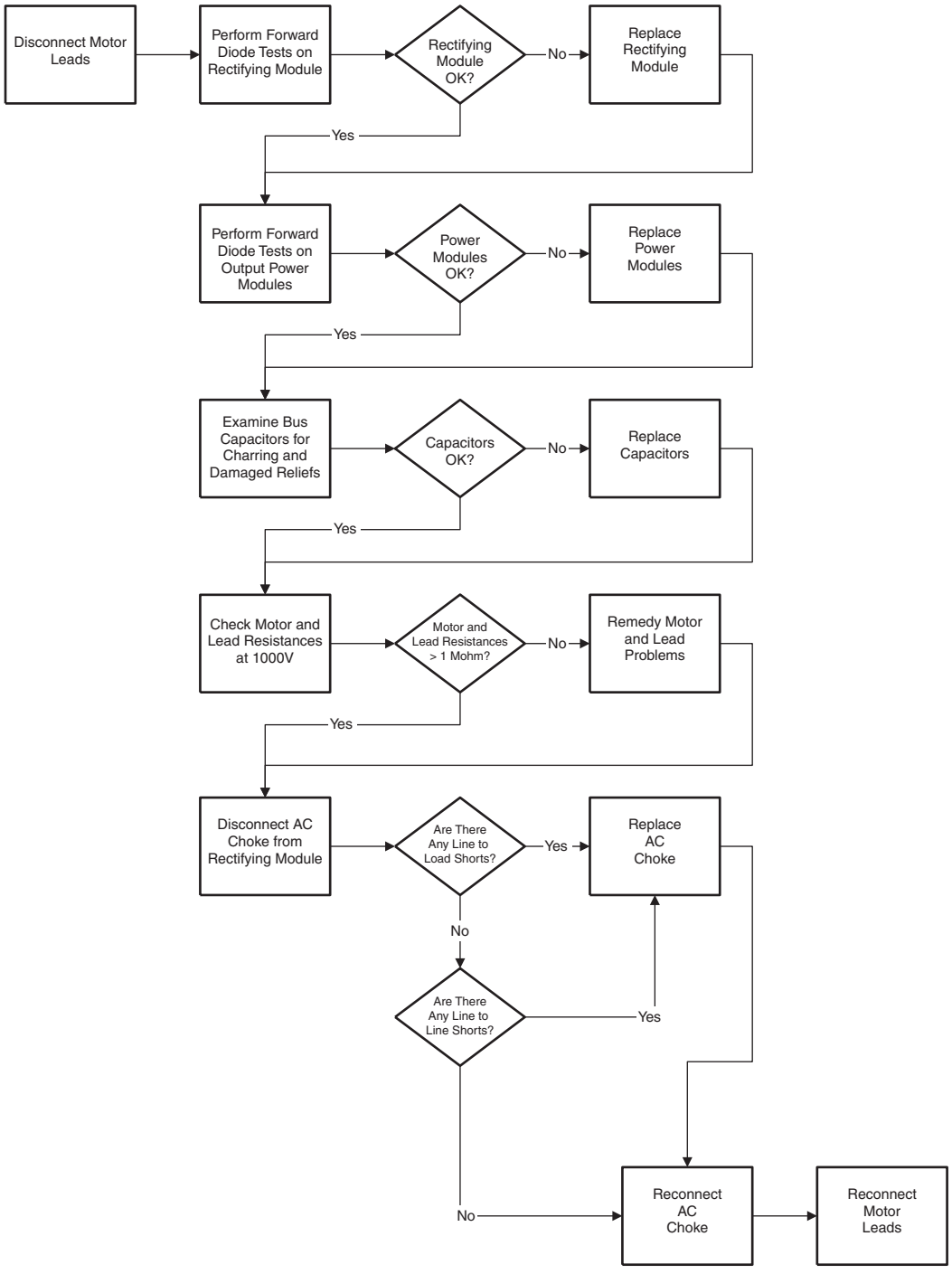
Name	No.	Description	Action *(if appropriate)*
OverVoltage	5	DC bus voltage exceeded maximum value.	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time or install and external dynamic brake option.
Input Phase	17	One input line phase missing.	Check user-supplied fuses Check AC input line voltage.
OutPhasMissng	21	Zero current in one output motor phase.	Check motor wiring. Check motor for open phase.
Ground Fault	13	A current path to earth ground greater than 25% of drive rating. Ground fault level is 50% of the drive's heavy duty current rating. The current must appear for 800ms before the drive will fault.	Check the motor and external wiring to the drive output terminals for a grounded condition.
InverterFault	14	Hardware problem in the power structure.	Cycle power. Replace drive.
System Fault	10	Hardware problem exists in the power structure.	Cycle power. Replace drive.
Load Loss	15	Do not use this fault in 700H applications	Check that parameter 238 [Fault Config 1] / bit 0 [Power Loss] and parameter 259 [Alarm Config 1] / bit 13 [Load Loss] are set to zero.
HiHp Drv OvrLoad	31	Drive Overload - the circuit board on the Power module has detected an overload.	Measure output current of the drive. If the level is ever greater than the maximum drive rated output current level reduce the load. If the levels are always well below the drive rated levels, then replace the power module.
Power Unit	70	One or more of the output transistors were operating in the active region instead of desaturation. This can be caused by excessive transistor current or insufficient base drive voltage.	Clear fault.

Diagnostic Procedures by Symptom

The following charts list drive symptoms, symptom descriptions and recommended actions.

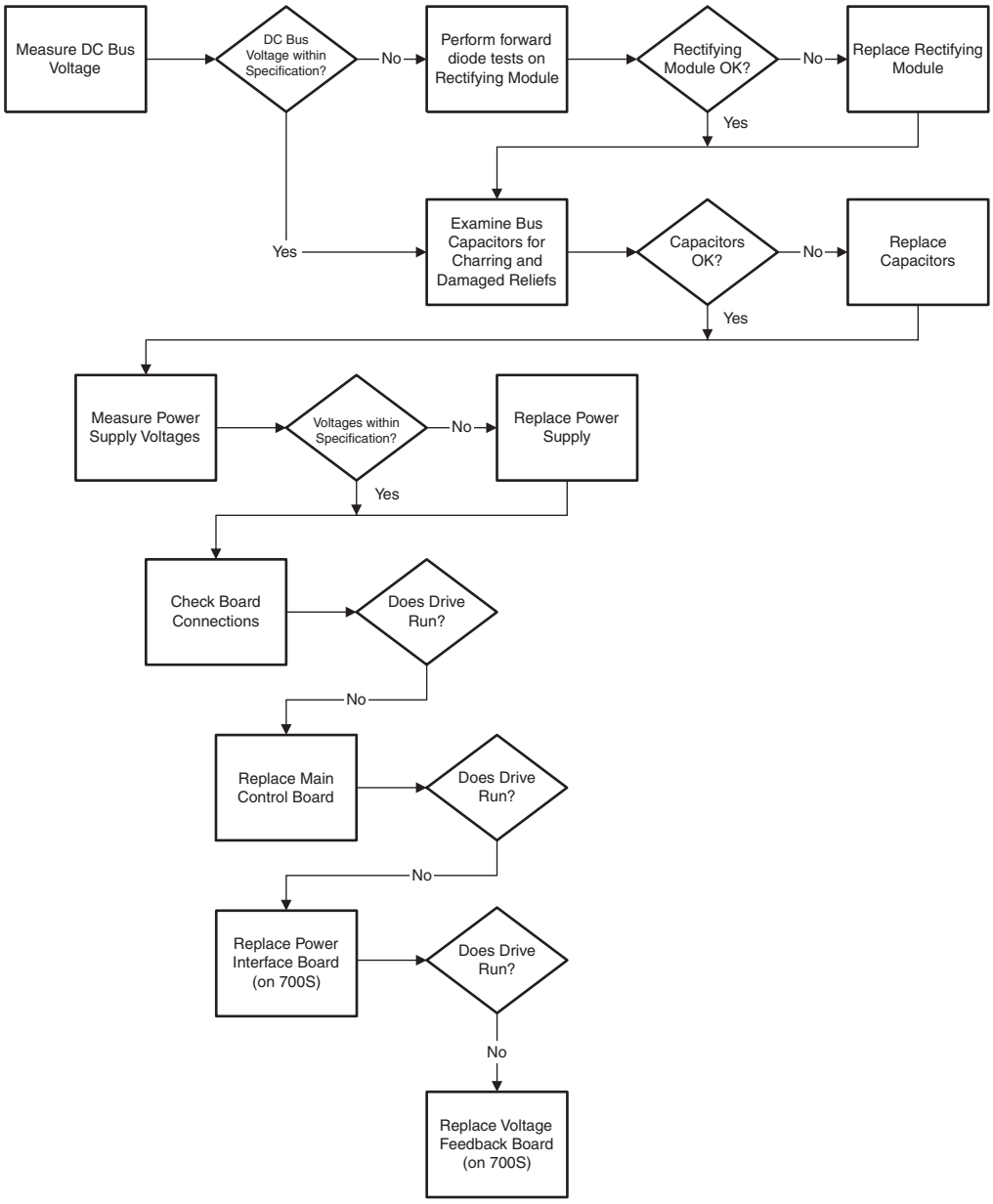
Blown Input Fuses

Use this procedure when a drive clears any of its external circuit breaker or power fuses:



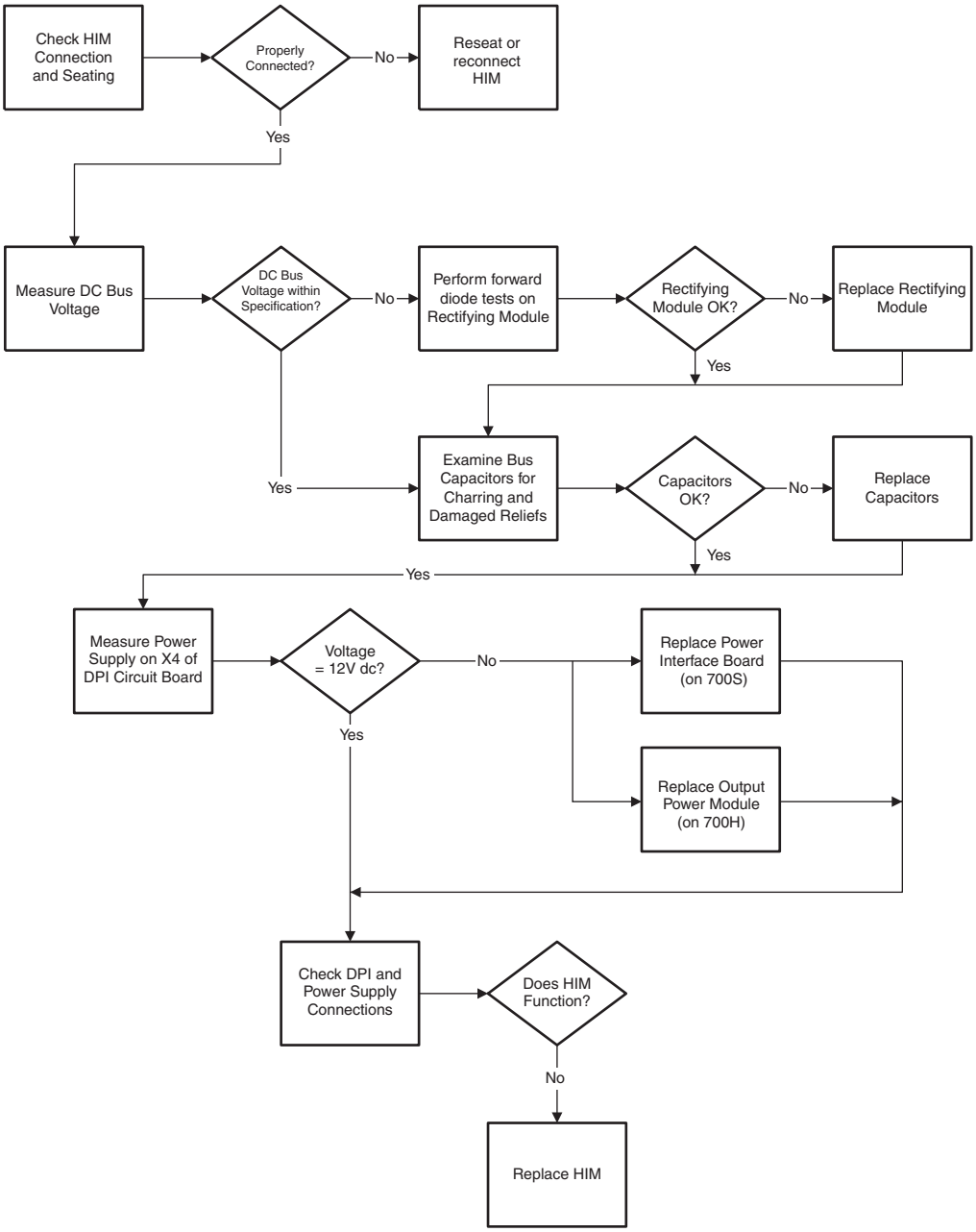
No Output Voltage

Use this procedure when there is no voltage present at the drive output terminals, even though the drive indicates the motor is running:



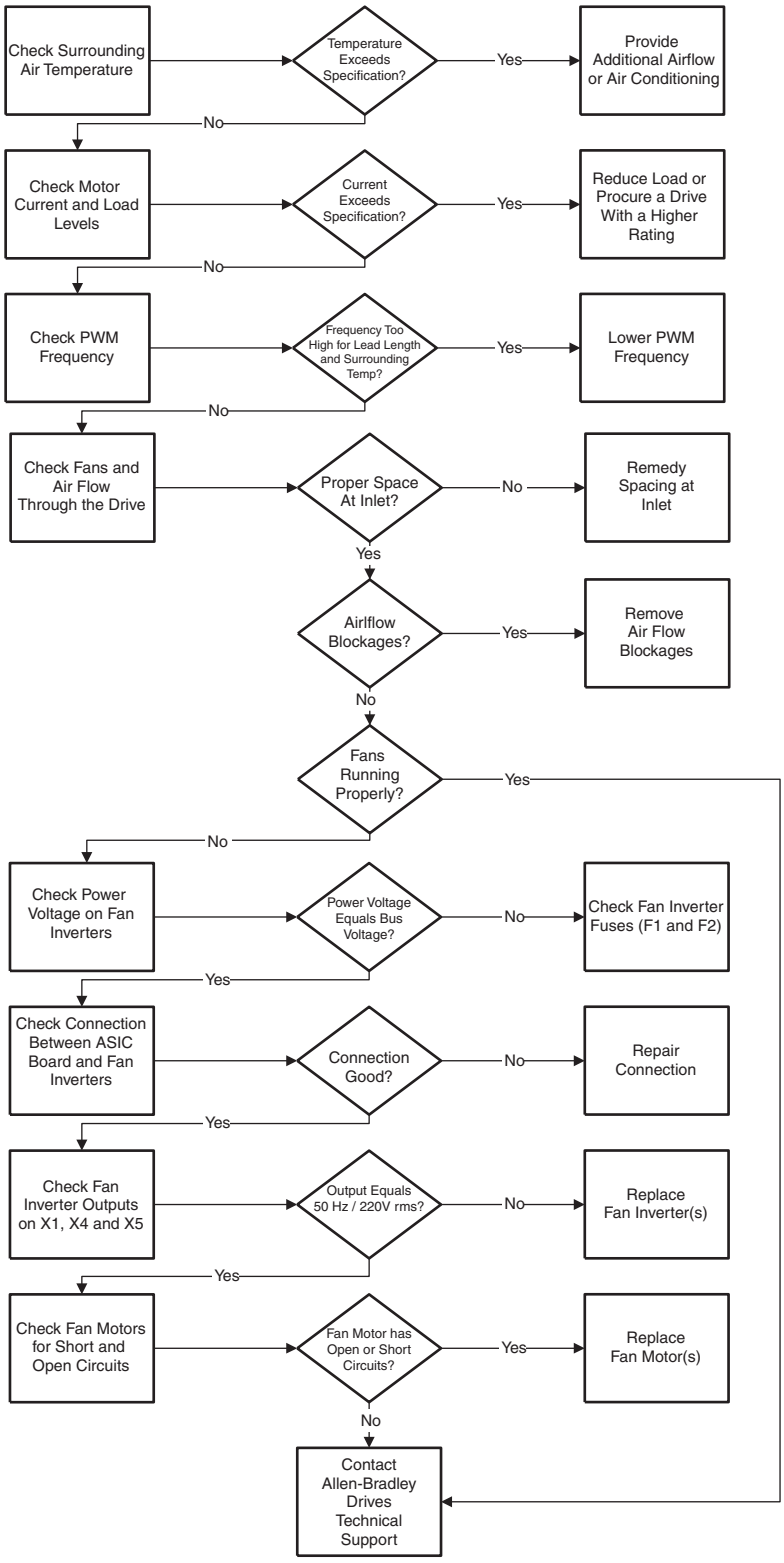
No HIM Display

Use this procedure when the HIM does not function:



Over-Temperature Faults

Use this procedure to troubleshoot drive over-temperature faults (14 - Inv Otemp Pend and 15 - Inv Otemp Trip in 700S or 8 - Heatsink OvrTemp and 9 - Trnsistr OvrTemp in 700H):



Component Test Procedures

ATTENTION: To avoid an electric shock hazard, ensure that all power to the drive has been removed before performing the following.

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the DC+ & DC- terminals. The voltage must be zero.

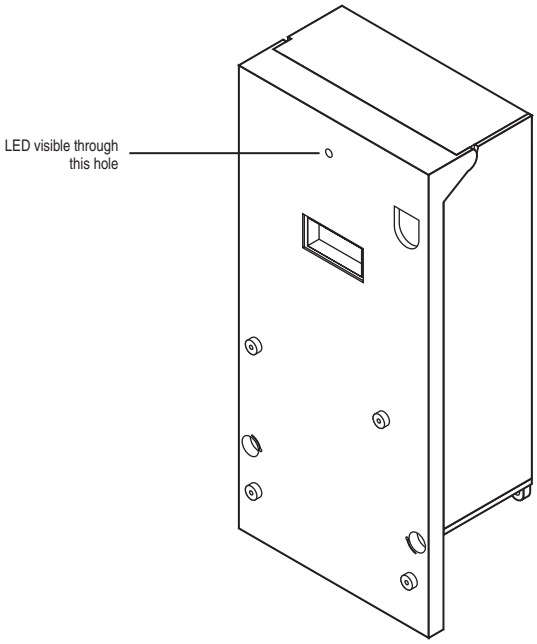
ATTENTION: HOT surfaces can cause severe burns. **Do not** touch the heatsink surface during operation of the drive. After disconnecting power allow time for cooling.

ATTENTION: This drive contains **ESD** (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, "Guarding Against Electrostatic Damage" or any other applicable ESD protection handbook.

Viewing the 700H Diagnostic LED

The Control Assembly on 700H drives contains a diagnostic LED which is visible through the cover of the Control Assembly.

ATTENTION: The Control Assembly LED is only operational when the drive is energized, and only visible with the door of the drive enclosure is open. Servicing energized equipment can be hazardous. Severe injury or death can result from electrical shock, burn or unintended actuation of controlled equipment. Follow Safety related practices of NFPA 70E, *ELECTRICAL SAFETY FOR EMPLOYEE WORKPLACES*. DO NOT work alone on energized equipment!



LED	Indication
Steady	The drive is operational and has no faults
Flashing Quickly	• Switching power supply overload • Rectifier board fault • Fan or fan inverter fault • Brake Chopper fault • Fiber Optic Adapter board Fault
Flashing Slowly	Bad connection between circuit boards, check all connections

Viewing the 700S Diagnostic LEDs

The PowerFlex 700S contains a Run LED, controller LEDs, and SynchLink LEDs. These LEDs are only operational when the drive is energized and are only visible when the drive door is open. The status of these LEDs can also be viewed from the HIM or from an application program (e.g., DriveExplorer™) in parameter 554 [LED Status]. This feature is only available with DriveLogix version 15.03 or later.

ATTENTION: The RUN LED and the controller LEDs are only operational when the drive is energized. Servicing energized equipment can be hazardous. Severe injury or death can result from electrical shock, burn or unintended actuation of controlled equipment. Follow Safety related practices of NFPA 70E, *ELECTRICAL SAFETY FOR EMPLOYEE WORKPLACES*. DO NOT work alone on energized equipment!

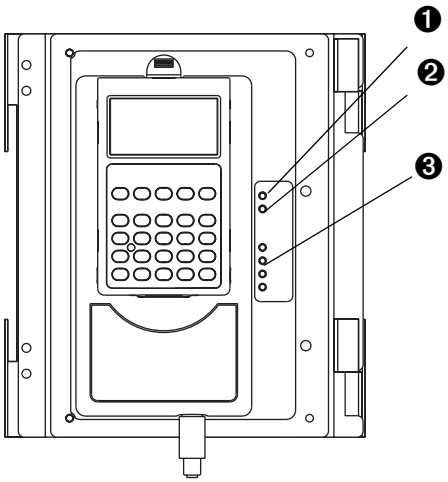


Table C Drive Status Indicator Descriptions

			#	Name	Color	State	Description
DRIVE	Power Structure		❶	PWR (Power)	Green	Steady	Illuminates when power is applied to the drive.
			❷	STS (Status)	Green	Flashing	Drive ready, but not running & no faults are present.
						Steady	Drive running, no faults are present.
					Yellow	Flashing	When running, a type 2 (non-configurable) alarm condition exists, drive continues to run. When stopped, a start inhibit exists and the drive cannot be started.
						Steady	A type 1 (user configurable) alarm condition exists, but drive continues to run.
					Red	Flashing	A fault has occurred.
						Steady	A non-resettable fault has occurred.
					Red / Yellow	Flashing Alternately	The drive is in flash recovery mode. The only operation permitted is flash upgrade.
	Control Assembly	Communications	❸	PORT	Refer to the *Communication Adapter User Manual*		Status of DPI port internal communications (if present).
				MOD			Status of communications module (when installed).
				NET A			Status of network (if connected).
				NET B			Status of secondary network (if connected).
		Control	(1)	SYNCHLINK	Green	Steady	The module is configured as the time keeper. or The module is configured as a follower and synchronization is complete.
					Green	Flashing	The follower(s) are not synchronized with the time keeper.
					Red	Flashing	The module is configured as a time master on SynchLink and has received time information from another time master on SynchLink.
				ENABLE	Green	On	The drive's enable input is high.
					Green	Off	The drive's enable input is low.

(1) SynchLink LEDS are located on the SynchLink daughtercard on the main circuit board in the control cassette.

Performing Visual Inspections

Visually inspect the cooling tunnels and power structure before energizing the drive.

Inspecting the Cooling Tunnels

1. Remove the main cooling fans from the bottom of the power structure. Refer to Removing the Main Fans on page 3-24.
2. Inspect the tunnels. Clean the heatsinks and tunnels if necessary.

Inspecting the Power Structure

1. Remove the covers from the power structure. Refer to Removing the Covers from the Power Structure on page 3-13.
2. Check components for burn marks, breakage or foil delamination on circuit boards. Check all the boards on the power structure, including those on the Output Power modules and the Rectifying module(s) (if present).

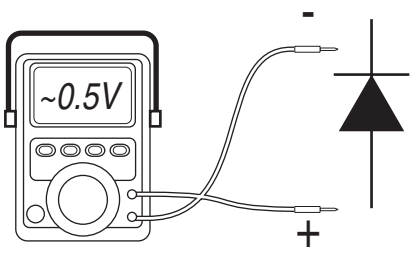
   Replace any of these components without further testing if they show evidence of burn marks, breakage or foil delamination.

Conducting Forward and Reverse Biased Diode Tests for Major Power Components

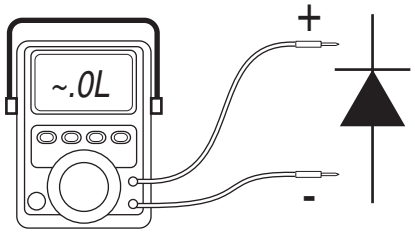
A forward biased diode test checks the semiconductor junctions between the terminals and measures the voltage drop across those junctions. To pass each test, the meter must display a voltage near 0.5V. If the test finds a short, the meter will display ".000." If the test finds an open circuit or reversed polarity, the meter will display ".0L" (zero load).

A reverse biased diode test should find an open circuit, and the meter should display ".0L" (zero load).

Important: 600V ac input, 460A and 502A frame 11 drives only have one Rectifying module. For all other drive configurations, you must complete these procedures for both Rectifying modules.



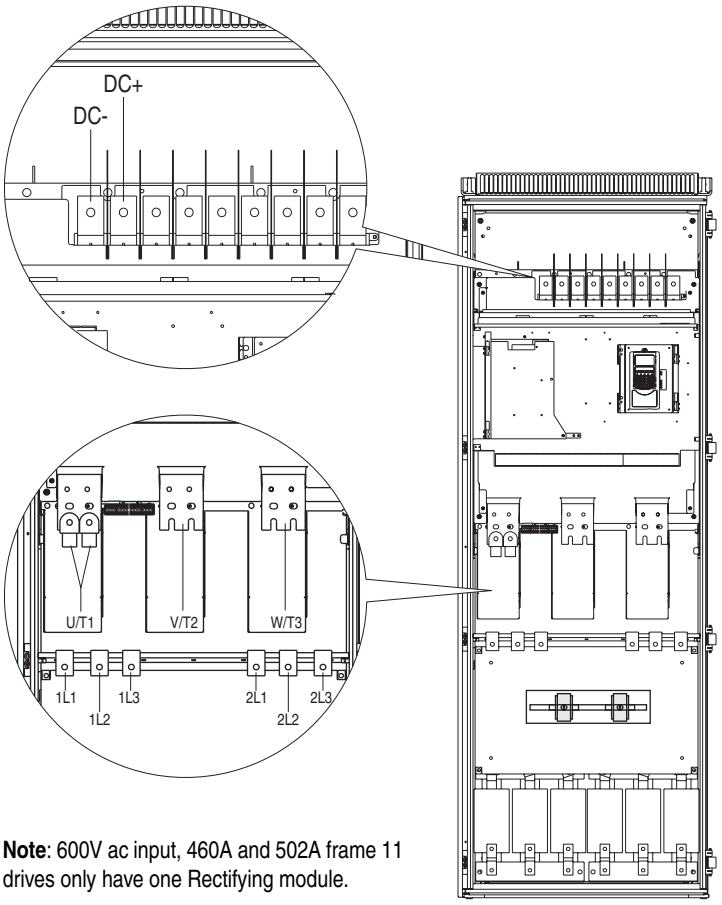
Forward biased test on PN-junction



Reverse biased test on PN-junction

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Disconnect the motor leads from the drive.
3. On ac input drives, conduct forward and reverse biased diode tests on the Rectifying module(s).

Figure 2.1 Measurement Points for Forward and Reverse Diode Tests



Note: 600V ac input, 460A and 502A frame 11 drives only have one Rectifying module.

Table 2.A Forward Biased Diode Tests on Rectifying Module(s)

Meter Leads		Nominal meter reading
+	-	
L1	DC+	Value should gradually rise to about 0.5V
L2	DC+	
L3	DC+	
DC-	L1	
DC-	L2	
DC-	L3	

Table 2.B Reverse Biased Diode Tests on Rectifying Module(s)

Meter Leads		
+	-	Nominal meter reading
L1	DC-	Meter should display ".0L" (zero load)
L2	DC-	
L3	DC-	
DC+	L1	
DC+	L2	
DC+	L3	

If the drive fails any of these measurements, replace all Rectifying modules.

4. Conduct forward and reverse biased diode tests on the Output Power modules.

Table 2.C Forward Biased Diode Tests on Output Power Modules

Meter Leads		
+	-	Nominal meter reading
DC-	T1	Meter should display ".0L" (zero load)
DC-	T2	
DC-	T3	
T1	DC+	
T2	DC+	
T3	DC+	

Table 2.D Reverse Biased Diode Tests on Output Power Modules

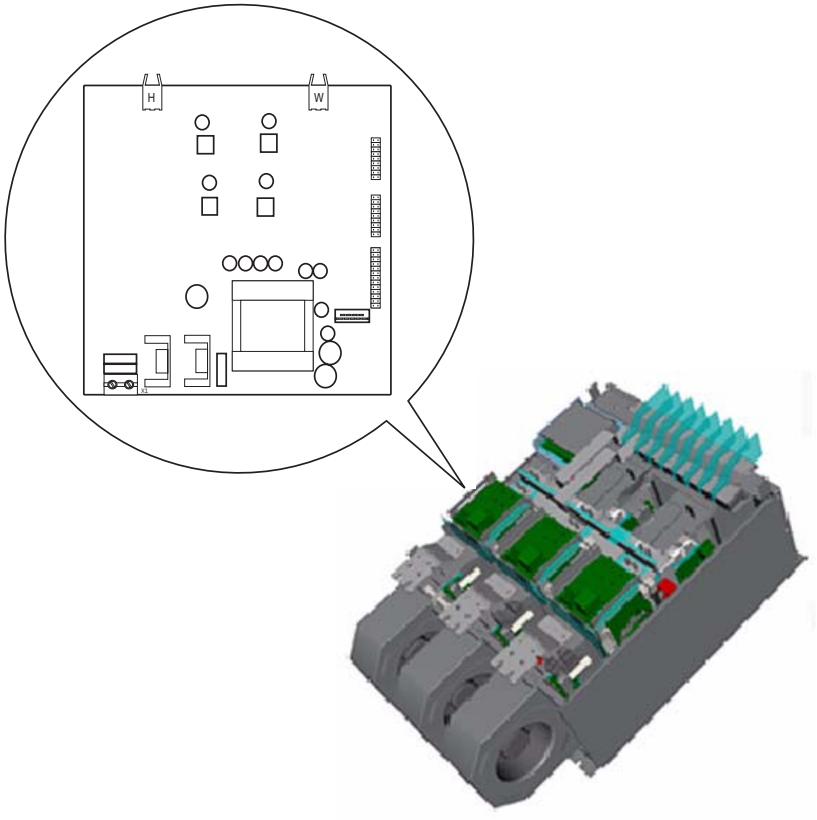
Meter Leads		
+	-	Nominal meter reading
T1	DC-	Value should gradually rise to about 0.5V
T2	DC-	
T3	DC-	
DC+	T1	
DC+	T2	
DC+	T3	

If the drive fails any of these measurements, replace all three Output Power modules.

Checking Fiber Optic Connections to the Gate Driver Boards

Damaged or improperly connected fiber optic cables can cause apparent Gate Driver board malfunctions.

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the covers from the power structure. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Locate the three Gate Driver boards on the front of the power structure.



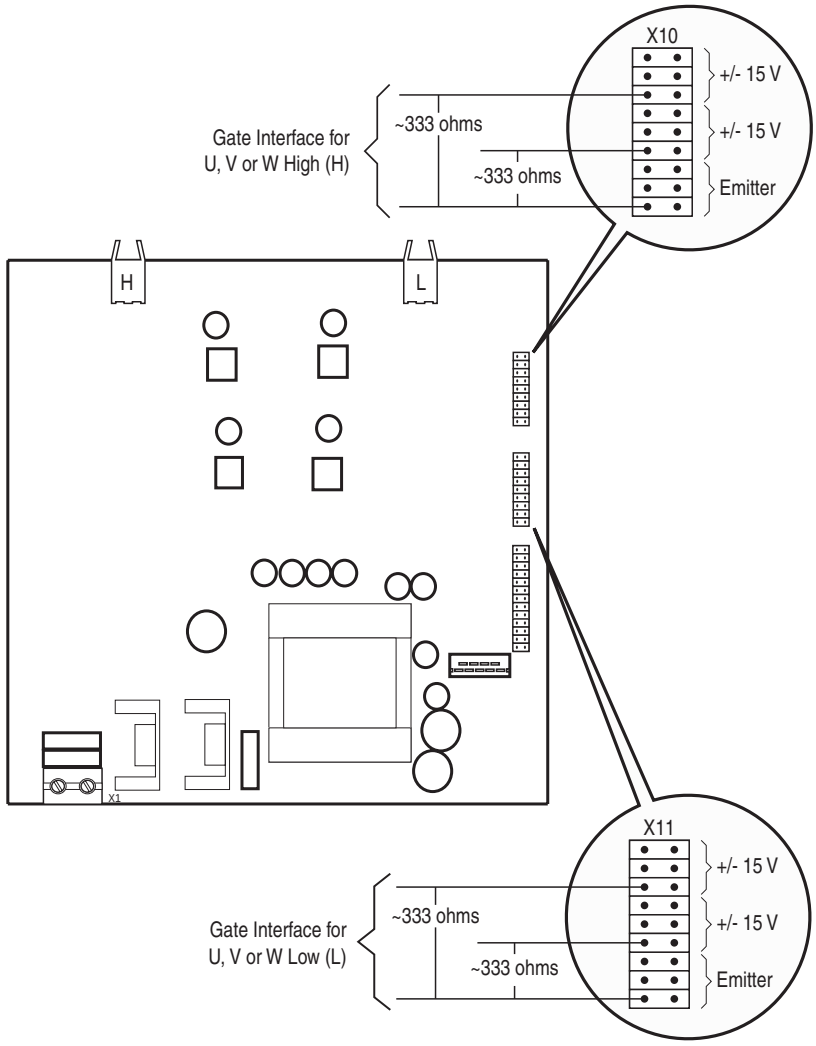
4. Verify the fiber optic cables are properly connected (refer to Figure B.7 on page B-8, Figure B.8 on page B-9, Figure B.9 on page B-10, or Figure B.10 on page B-11).
5. Disconnect the cables and inspect them for scratches and cracks.
6. Reconnect the cables, replacing any damaged cables.

Conducting Gate Driver Board Measurements

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the covers from the power structure. Refer to Removing the Covers from the Power Structure on page 3-13.

Gate Interface Resistance

There are three Gate Driver boards, one per output power module. Measure the gate interface resistance for each output power transistor. The resistance from each gate and collector pin to the branch emitter pin should be about 333 ohms. If any of the gate interfaces fails this test, replace the appropriate (left, middle, or right) output power module.



Preparing the Drive for Active Measurements on the Gate Driver Board

Important: This procedure requires special equipment and training. Only qualified and trained personnel should perform these procedures. *If you do not have the special equipment, replace the Gate Driver board to determine if the board is malfunctioning.*

Important: A High Voltage DC Test Power Supply is required to perform these tests.

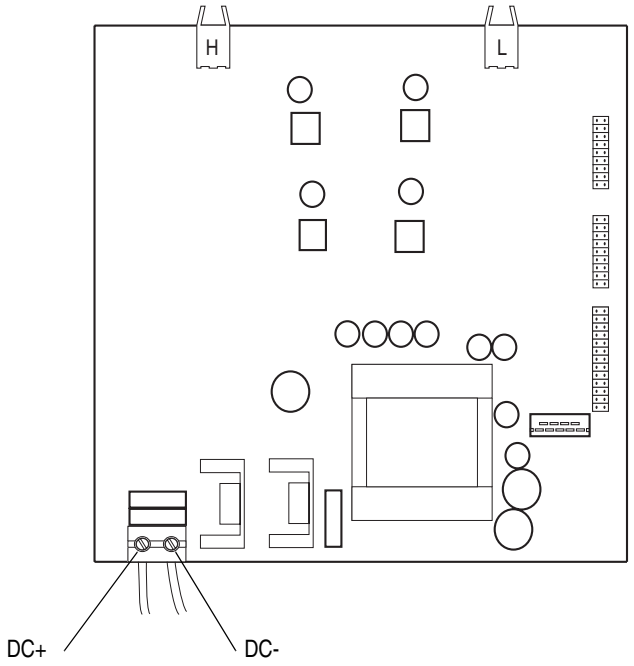
1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the covers from the power structure. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Disconnect the Main Fan Inverters power supply cables in order to prevent them from running during these tests.

ATTENTION: Running the drive without the Main Fan Inverters could cause the drive to overheat or fault. Possible equipment damage could occur. You must replace the fuses before running the drive.

4. Disconnect the fiber optic cables that connect the ASIC board to the three Gate Driver boards at the Gate Driver board ends.
5. Disconnect the plug from the X6 connector on the ASIC board.
6. Make the following connections from a High Voltage DC Test Power Supply to X6 on the ASIC board using a new connector plug.

From High Voltage DC Test Power Supply	To this pin on the X6 on ASIC Board
DC+	1
DC-	3
	Jumper pin 1 to pin 2 on connector

7. Disconnect the DC+ wire from each of the three Gate Driver boards.



8. Connect the High Voltage DC Test Power Supply DC- to the DC- Bus Bar.

9. Connect the High Voltage DC Test Power Supply DC+ to the DC+ on each Gate Driver board.

ATTENTION: The sheet metal cover and mounting screws on the ASIC board located on the power structure are energized at (-) DC bus potential high voltage. Risk of electrical shock, injury, or death exists if someone comes into contact with the assembly. Servicing energized equipment can be hazardous. Severe injury or death can result from electrical shock, burn or unintended actuation of controlled equipment. Follow Safety related practices of NFPA 70E, *ELECTRICAL SAFETY FOR EMPLOYEE WORKPLACES*. DO NOT work alone on energized equipment!

ATTENTION: Certain pins in connectors X7 and X12 on the Gate Driver board will be energized at DC bus potential high voltage. Risk of electrical shock, personal injury or death, property damage, or economic loss exists if personnel or equipment comes into contact with these pins.

10. Set the current limit on the High Voltage DC Test Power Supply to less than or equal to 1A. Energize the Supply and increase its output to the drive's nominal DC bus voltage (650V dc for drives with 380-500V ac input or 775V dc for drives with 600-690V ac input).

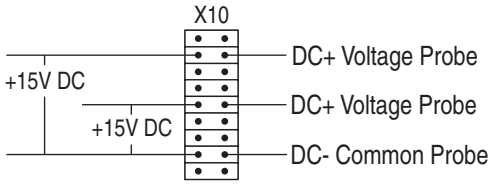
Checking the Opto-Couplers

Class 1 LED Product

ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into module ports or fiber-optic cable connectors.

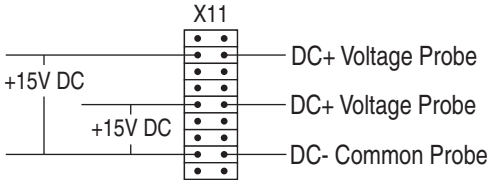
1. Locate the fiber optic receiver which transmits the signals for the U High (UH) gate interface and connector X10 on the Gate Driver board. X10 provides the gate interface for the UH output power transistor in the U Phase Output Power module.

2. Measure the DC voltage at each UH gate pin and the emitter pin on X10 by placing the DC- common probe on the emitter pin and the voltage probe on the gate pins.



3. While shining an intense light (like a flashlight) into the fiber optic receiver for the UH cable, measure the DC voltage at each UH gate pin and the emitter pin on X10 with respect to DC-. Each should be +15V dc. If the drive fails any of these tests, replace the fiber optic cable or the Gate Driver board.

4. Repeat steps 2 and 3 with connector X11 and the UL cable. X11 provides the gate interface for the UL output power transistor in the U Phase Output Power module. If the drive fails any of these tests, replace the Gate Driver board.



5. Repeat steps 2 and 3 with connector X10 and the VH cable. X10 provides the gate interface for the VH output power transistor in the V Phase Output Power module. If the drive fails any of these tests, replace the Gate Driver board.

6. Repeat steps 2 and 3 with connector X11 and the VL cable. X11 provides the gate interface for the VL output power transistor in the V Phase Output Power module. If the drive fails any of these tests, replace the Gate Driver board.

7. Repeat steps 2 and 3 with connector X10 and the WH cable. X10 provides the gate interface for the WH output power transistor in the W Phase Output Power module. If the drive fails any of these tests, replace the Gate Driver board.

8. Repeat steps 2 and 3 with connector X11 and the WL cable. X11 provides the gate interface for the WL output power transistor in the W

Phase Output Power module. If the drive fails any of these tests, replace the Gate Driver board.

9. Connect the multi-meter (ohms) black test lead to the DC- Bus Bar and the red test lead from the multi-meter to the output terminal on the U Phase.

10. Shine an intense light into the UL fiber optic receiver on the Gate Driver board. This should gate the IGBT and the multi-meter should indicate that the IGBT is short-circuited. This will happen if the circuit from the fiber optic receiver to the output terminal is functioning properly.

11. Connect the multi-meter red test lead to the DC+ Bus Bar and the black test lead to the UH output terminal.

12. Shine an intense light into the UH fiber optic receiver on the Gate Driver board. This should gate the IGBT and the multi-meter should indicate that the IGBT is short-circuited. This will happen if the circuit from the fiber optic receiver to the output terminal is functioning properly.

13. Repeat steps 9 - 12 for VL and VH on the V Phase Gate Driver board.

14. Repeat steps 9 - 12 for WL and WH on the W Phase Gate Driver board.

Important: The test does not verify that both blocks are operating. If one block is not operating, the drive will indicate an I^2T hardware fault.

Checking the Rectifying Module(s) on AC Input Drives

600V ac input, 460A and 502A frame 11 drives have only one Rectifying module. Complete the "Testing 600V AC Input, 460A and 502A Drives" procedure below only if you are checking the Rectifying module on a 600V ac input, 460A and 502A drive. If you are checking the Rectifying module on a 400V ac input, 590A, 650A or 730A, or 600V ac input, 590A drive refer to Testing 400V AC Input, 590A, 650A or 730A, or 600V AC Input, 590A Drives on page 2-14.

Testing 600V AC Input, 460A and 502A Drives

Important: This procedure requires special equipment and training. Only qualified and trained personnel should perform these procedures.

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.

2. Remove the covers from the power structure. Refer to Removing the Covers from the Power Structure on page 3-13.

3. Visually inspect the pre-charging resistors. If the pre-charging resistors are damaged:

   A. Replace all Rectifying modules (See Removing the W Phase (Right-Side) Rectifying Board, Rectifying Module and Output Power Module on page 3-36).

   B. Check the capacitors, rectifier(s) and external connections for short-circuits. (See Checking the DC Bus Capacitors on page 2-17)

   C. Check the Output Power modules (See Conducting Forward and Reverse Biased Diode Tests for Major Power Components on page 2-4).

4. Verify that the plugs on the cable that connects X13 on the Rectifying board to X2 on the ASIC board are properly seated.

5. Verify that the jumper at X50 on the Rectifying board is in place.

Taking Measurements on Rectifying Module

6. Disconnect connectors X13, X12, X11 and X10.

7. Perform resistance measurements, using a digital multimeter, on the points listed in Table 2.E below. These points are on the back of the X10, X11 and X12 plugs which you have disconnected from the board. **If the Rectifying Module fails any of these tests, replace it** (See Removing the W Phase (Right-Side) Rectifying Board, Rectifying Module and Output Power Module on page 3-36)**.**

Table 2.E Rectifying Module Resistance Measurements

Measurement points	Resistance
X10: red to X10: black	18Ω ± 1Ω
X11: red to X11: black	
X12: red to X12: black	

8. Without applying power to X13 verify that there is no resistance between the following points: J3 and X9, J7 and X9, and J11 and X9. Refer to Table 2.G on page 2-16. **If the Rectifying Module fails any of these tests, replace it** (See Removing the W Phase (Right-Side) Rectifying Board, Rectifying Module and Output Power Module on page 3-36)**.**

Important: Power supply polarity is critical during these tests. Reversing the polarity will damage components on the circuit board.

9. Connect the DC Test Power Supply to X13 (positive to pin 5 and common to pin 1). Raise the output of the DC Test Power Supply to 24V dc.

10. Verify that the voltage and resistance between the following points is zero: J3 and X10: Pin 1, J7 and X11: Pin 1, and J11 and X12: Pin 1. Refer to Table 2.G on page 2-16 below. **If the Rectifying Module fails any of these tests, replace it** (See Removing the W Phase (Right-Side) Rectifying Board, Rectifying Module and Output Power Module on page 3-36)**.**

Testing 400V AC Input, 590A, 650A or 730A, or 600V AC Input, 590A Drives

Important: This procedure requires special equipment and training. Only qualified and trained personnel should perform these procedures.

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.

2. Remove the covers from the power structure. Refer to Removing the Covers from the Power Structure on page 3-13.

3. Visually inspect the pre-charging resistors. If the pre-charging resistors are damaged:

A. Replace all Rectifying modules (See Removing the V Phase (Middle) Rectifying Board, Rectifying Module and Output Power Module on page 3-33 and Removing the W Phase (Right-Side) Rectifying Board, Rectifying Module and Output Power Module on page 3-36).

B. Check the capacitors, rectifier(s) and external connections for short-circuits. (See Checking the DC Bus Capacitors on page 2-17)

C. Check the Output Power modules (See Conducting Forward and Reverse Biased Diode Tests for Major Power Components on page 2-4).

4. On the first converter, verify that the plugs on the cable that connects X13 on the Rectifying board to X2 on the ASIC board are properly seated.

5. On the first converter, remove the X50 jumper from the Rectifying board.

6. Verify that the plugs on the cable that connects X6 on the Rectifying board of the first converter to X13 on the Rectifying board of the second converter are properly seated.

7. Verify that the jumper at X50 on the Rectifying board of the second converter is in place.

Taking Measurements on Rectifying Module

8. Disconnect connectors X13, X12, X11 and X10.

9. Perform resistance measurements, using a digital multimeter, on the points listed in Table 2.F below. These points are on the back of the X10, X11 and X12 plugs which you have disconnected from the board. **If this test fails, replace both Rectifying modules** (See Removing the V Phase (Middle) Rectifying Board, Rectifying Module and Output Power Module on page 3-33 and Removing the W Phase (Right-Side) Rectifying Board, Rectifying Module and Output Power Module on page 3-36)**.**

Table 2.F Rectifying Module Resistance Measurements

Measurement points	Resistance
X10: red to X10: black	18Ω ± 1Ω
X11: red to X11: black	
X12: red to X12: black	

10. Without applying power to X13 verify that there is no resistance between the following points: J3 and X9, J7 and X9, and J11 and X9. Refer to Table 2.G on page 2-16. **If this test fails, replace both Rectifying modules** (See Removing the V Phase (Middle) Rectifying Board, Rectifying Module and Output Power Module on page 3-33 and Removing the W Phase (Right-Side) Rectifying Board, Rectifying Module and Output Power Module on page 3-36)**.**

Important: Power supply polarity is critical during these tests. Reversing the polarity will damage components on the circuit board.

11. Connect the DC Test Power Supply to X13 (positive to pin 5 and common to pin 1). Raise the output of the DC Test Power Supply to 24V dc.

12. Verify that the voltage and resistance between the following points is zero: J3 and X10: Pin 1, J7 and X11: Pin 1, and J11 and X12: Pin 1. Refer to Table 2.G on page 2-16. **If this test fails, replace both Rectifying modules** (See Removing the V Phase (Middle) Rectifying Board, Rectifying Module and Output Power Module on page 3-33 and Removing the W Phase (Right-Side) Rectifying Board, Rectifying Module and Output Power Module on page 3-36)**.**

Figure 2.2 Rectifying board layout and measurement points

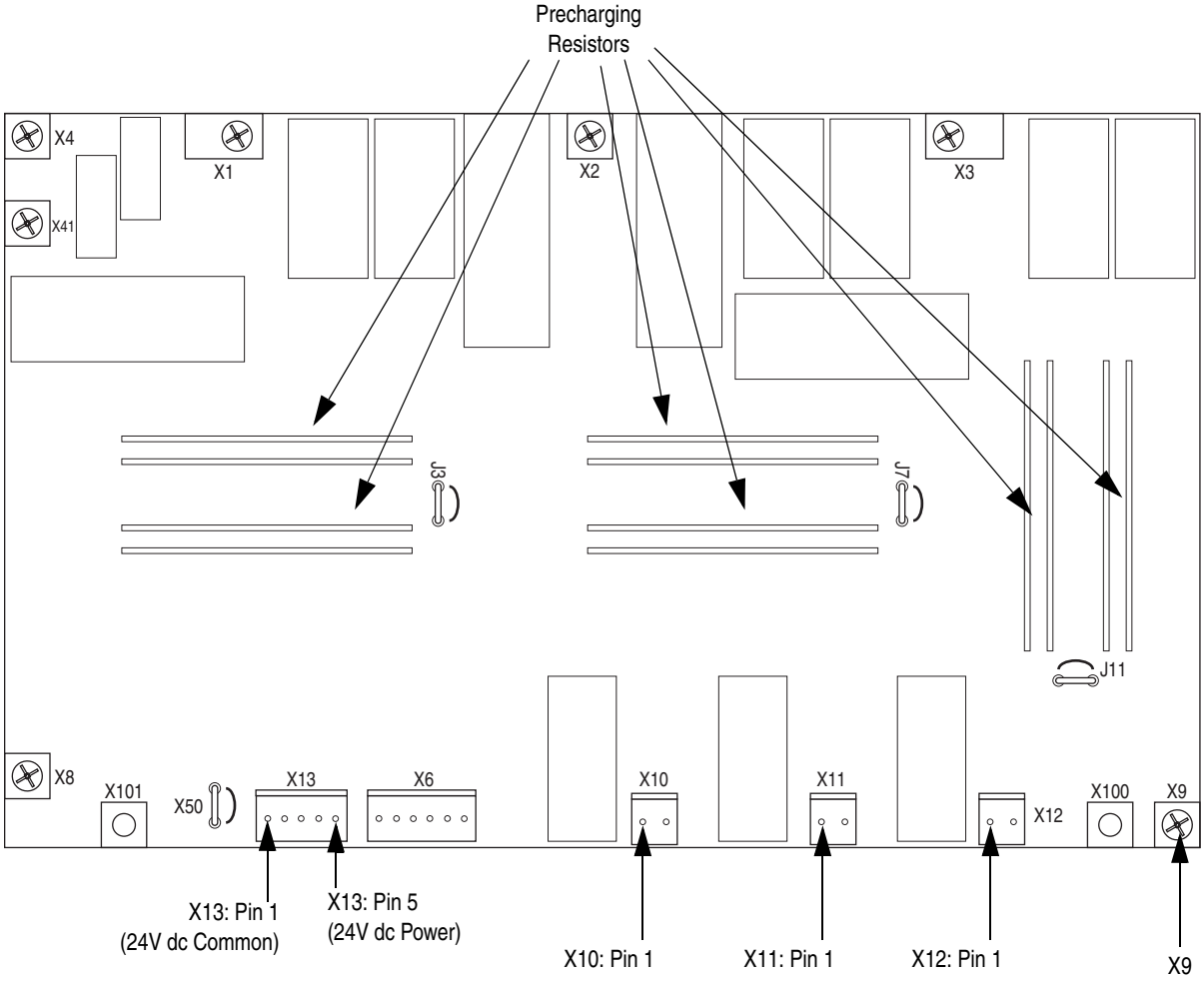


Table 2.G Rectifying Board Charge Relay Test Results

No Power on X13			24V dc Power on X13		
Meter Leads			Meter Leads		
+	-	Results	+	-	Results
J3	X9	0Ω	J3	X10: Pin 1	0Ω / 0V
J7	X9		J7	X11: Pin 1	
J11	X9		J11	X12: Pin 1	

Checking the DC Bus Capacitors

Important: This procedure requires special equipment and training. Only qualified and trained personnel should perform these procedures.

These tests require the recommended high voltage DC-power supply.

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the covers from the power structure. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Set the current limit of the DC power supply to less than 50mA.
4. Connect the power supply's DC+ to the drive's DC+ terminal and the power supply's DC- to the drive's DC- terminal.
5. Set the power supply voltage setting to zero.
6. Switch on the external DC power supply.
7. Slowly increase the external DC power supply output voltage to the drive's nominal DC bus voltage (650V dc for drives with 380-500V ac input or 775V dc for drives with 600-690V ac input).
8. Monitor the current while testing. Leakage current should be less than 3mA when voltage has stabilized.
9. Abort test if current leakage is significantly higher when voltage has stabilized.
10. Decrease the DC power supply output voltage to zero. Wait until DC bus voltage has decreased to zero. Switch off the external DC power supply.
11. As a precaution, use a resistor to discharge each capacitor after testing. Use a resistor with the proper resistance and power handling capability for the discharge current.
12. If any capacitor has failed. Replace all the capacitors in the same series connection (See Removing the DC Bus Capacitors on page 3-38).

Checking the Main Fan Inverters and Fans

Checking Inverter LEDs

A frame 11 drive has three fans and three fan inverters. Each fan inverter has a red and a green diagnostic LED.

ATTENTION: The inverter LEDs are only operational when the drive is energized, and only visible with the covers removed from the power structure. Servicing energized equipment can be hazardous. Severe injury or death can result from electrical shock, burn or unintended actuation of controlled equipment. Follow Safety related practices of NFPA 70E, *ELECTRICAL SAFETY FOR EMPLOYEE WORKPLACES*. DO NOT work alone on energized equipment!

LED		
Red	**Green**	**Indication**
Steady	Steady	Inverter Idle
Off	Flashing	Inverter Running
Flashing	Steady	Inverter Faulted or No Control from ASIC board

Checking Fan Inverter Fuses

A pair of fuses (F1 and F2) feed DC Bus power to both inverters. Locate these fuses and, using a multi-meter, verify that they are not open.

Isolating a Faulty Fan Inverter

The ASIC board controls all three fan inverters. A cable connects X11 on the ASIC board to X8 on the first inverter. Another cable connects X3 of the first inverter to X8 on the second inverter. Another cable connects X3 of the second inverter to X8 on the third inverter. A jumper terminates X3 on the third inverter. Refer to Figure B.11 on page B-12. Use the following procedure to isolate a faulty inverter if the main fans are not running:

1. Disconnect the cable from X3 of the second inverter.
2. Remove the jumper from X3 of the third inverter, and connect it to X3 of the second inverter.
3. Energize the drive. If only the fans on the first and second inverters run, then the fan on the third inverter is faulty.
4. Disconnect the cable from X3 of the first inverter.
5. Remove the jumper from X3 of the third inverter, and connect it to X3 of the first inverter.
6. Energize the drive. If only the fans on the first and third inverters run, then the fan on the second inverter is faulty. If none of the fans run, then the first inverter is faulty.

Checking the Main Fan Motors

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the covers from the power structure. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Disconnect the first fan motor from its inverter.
4. Measure the resistance of the fan windings. If the resulting measurements are not similar to those in Table 2.H below, replace the fan (See Removing the Main Fans on page 3-24).

Table 2.H Correct Fan Measurements

Connection Wires	Resistance ± 5%
Brown-Black	60
Blue-Black	26
Blue-Brown	34
Resistance to ground	∞ (infinity)

5. Reconnect the first fan motor to its inverter.
6. Repeat steps 3-4 for the second and third fan motor.

Notes:

Access Procedures

ATTENTION: To avoid an electric shock hazard, ensure that all power to the drive has been removed before performing the following.

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the DC+ & DC- terminals. The voltage must be zero.

ATTENTION: The sheet metal cover and mounting screws on the ASIC Board located on the power structure are energized at (-) DC bus potential high voltage. Risk of electrical shock, injury, or death exists if someone comes into contact with the assembly.

ATTENTION: HOT surfaces can cause severe burns. **Do not** touch the heatsink surface during operation of the drive. After disconnecting power allow time for cooling.

ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into fiber-optic ports or fiber-optic cable connectors.

ATTENTION: This drive contains **ESD** (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.

Torque Specifications

The following table lists fastener torque specifications:

Item	Screw	Final Torque
DPI / HIM Assembly Door	M3 x 6 Phillips®	0.9 N-m (8 lb.-in.)
DPI / HIM Assembly (mounting)	M3 x 6 Phillips	0.9 N-m (8 lb.-in.)
700S Power Interface Circuit Board (mounting)	M3 x 6 Phillips	0.9 N-m (8 lb.-in.)
700H I/O and Control Assembly	M4 x 8 self-tapping	0.8 N-m (7 lb.-in.)

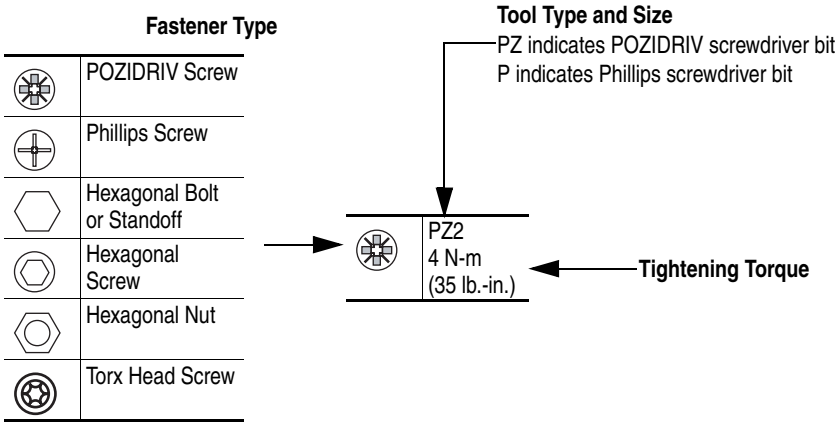
Item	Screw	Final Torque
700H Fiber Optic Adapter Board (mounting)	M4 x 8 POZIDRIV ®	0.9 N-m (8 lb.-in.)
700S Voltage Feedback Circuit Board (mounting)	M3 x 6 Phillips	0.9 N-m (8 lb.-in.)
AC Input Terminals on Power Structure	M10 nut	40 N-m (354 lb.-in.)
Motor Output Terminals on Power Structure	M8 x 20 hexagonal screw	20 N-m (177 lb.-in.)
Main Fan (Mounting)	M6 x 20 POZIDRIV	3 N-m (27 lb.-in.)
Main Fan	M4 x 8 POZIDRIV	1.7 N-m (15 lb.-in.)
Touch Cover (Main Fan)	M5 x 16	3 N-m (27 lb.-in.)
ASIC Fan	M4 x 16 POZIDRIV	0.4 N-m (3.5 lb.-in.)
Rectifier board (Mounting)	M4 x 8 POZIDRIV	1 N-m (9 lb.-in.)
Output Power Module Output Terminals (U,V,W)	M8 x 20 hexagonal screw	14 N-m (124 lb.-in.)
Rectifying Module Input Terminals (L1,L2,L3)	M10 x 20 hexagonal screw	12 N-m (106 lb.-in.)
Y-Bus Bar	M10 nut	40 N-m (354 lb.-in.)
Capacitor	M4 x 8 self tapping	1 N-m (9 lb.-in.)
Capacitor Bus Bar	M6 x 16 POZIDRIV	4 N-m (35 lb.-in.)
Capacitor Bus Bar	M6 x 20 POZIDRIV	4 N-m (35 lb.-in.)
DC- / DC+ Terminals	M6 x 20 POZIDRIV	5 N-m (44 lb.-in.)
Block (Mounting)	M10 x 12 hexagonal screw	20 N-m (177 lb.-in.)
700S Voltage Feedback Circuit Board (mounting)	M3 x 0.5 thread - 37 mm x 37 mm hex standoff	0.9 N-m (8 lb.-in.)

POZIDRIV® is a registered trademark of the Phillips Screw Company

Phillips® is a registered trademark of Phillips Screw Company

Understanding Torque Figures in Assembly Diagrams

Icons and numbers in the assembly diagrams indicate how to tighten hardware:



Removing Power from the Drive

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. Measure the DC bus voltage at the DC+ & DC- terminals. The voltage must be zero.

Remove power before making or breaking cable connections. When you remove or insert a cable connector with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

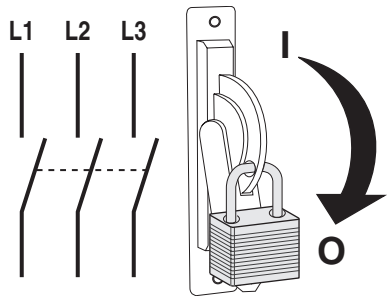
- sending an erroneous signal to your system's field devices, causing unintended machine motion
- causing an explosion in a hazardous environment

Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

Removing Power

1. Turn off and lock out input power. Wait five minutes.
2. Verify that there is no voltage at the drive's input power terminals.

3. Measure the DC bus voltage at the DC+ & DC- terminals on the Power Terminal Block. The voltage must be zero.



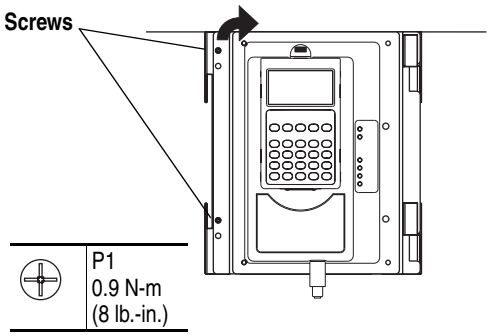
Removing the DPI / HIM Assembly

Removal

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.

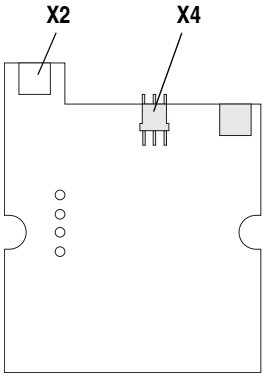
Important: Before removing connections and wires, mark the connections and wires to avoid incorrect wiring during assembly.

2. Remove the two screws from the front of the DPI / HIM assembly.



3. Open the door, which holds the DPI interface and HIM.

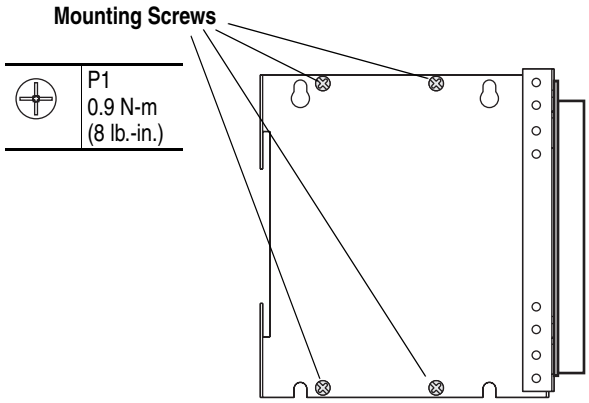
4. Unplug the DPI cable from the X2 connector on the DPI Interface Circuit Board.



Back view of DPI Circuit Board which should remain mounted on the back of the assembly

5. On 700S drives only, unplug the cable from the X4 connector on the circuit board.

6. Remove the four mounting screws and the assembly from the Control Frame.



Installation

Install the DPI / HIM Assembly in the reverse order of removal, while referring to Torque Specifications on page 3-1.

Removing the 700S Control Assembly

Removal

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.

Important: Before removing connections and wires, mark the connections and wires to avoid incorrect wiring during assembly.

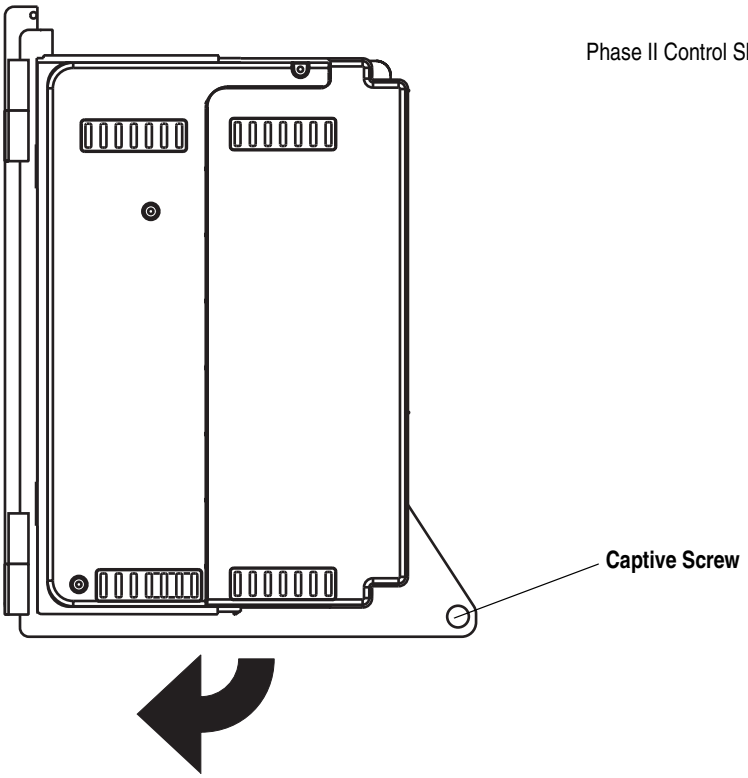
2. Unplug any fiber optic ControlNet and SynchLink cables from the Control Assembly.

ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into fiber-optic ports or fiber-optic cable connectors.

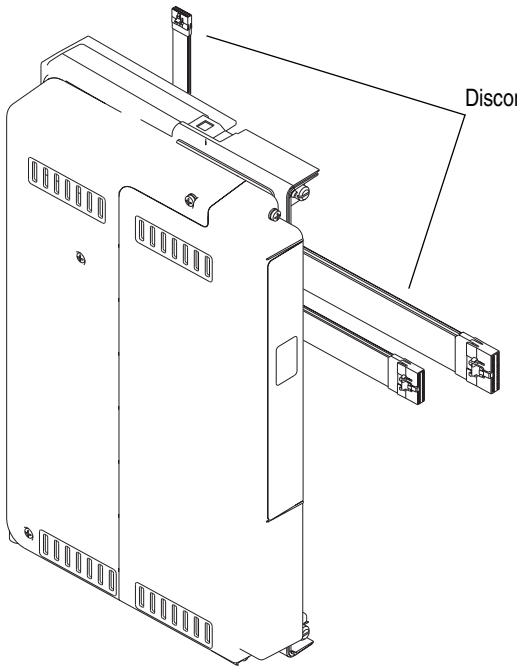
Important: Minimum inside bend radius for SynchLink and ControlNet fiber-optic cable is 25.4 mm (1 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable. Signal attenuation increases with decreased inside bend radii.

3. Unplug any remaining I/O and communications cables from the Control Assembly and set them aside.

4. Loosen the captive screw on the Control Assembly mounting plate and swing the Control Assembly away from the drive.

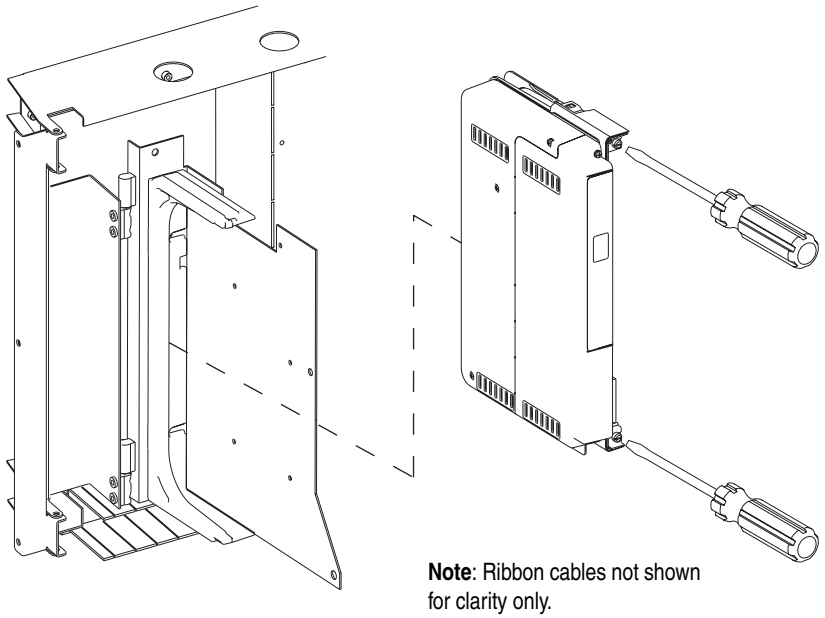


5. Carefully disconnect the ribbon cables from the sockets on the High Power Fiber Optic Interface Circuit Board on the back of the control mounting plate, and carefully set them aside.



Note: Control mounting plate not shown for clarity only.

6. Loosen the two mounting screws on the front of the Control Assembly and slide the cassette control off the mounting bracket.



Note: Ribbon cables not shown for clarity only.

Installation

Install the 700S Control Assembly in the reverse order of removal, while referring to Torque Specifications on page 3-1.

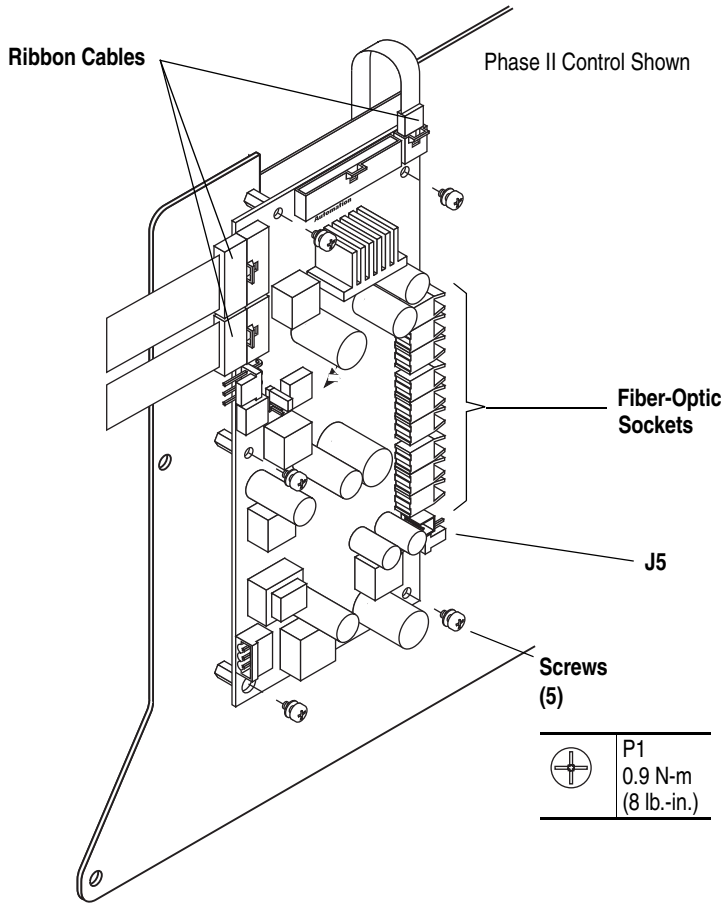
Removing the 700S High Power Fiber Optic Interface Circuit Board

Removal

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the 700S Control Assembly. Refer to (Removing the 700S Control Assembly on page 3-5.
3. Carefully disconnect the fiber-optic cables from the sockets along the right side of the High Power Fiber Optic Interface Circuit Board (on the backside of the Control Assembly), and carefully set them aside.

ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into fiber-optic ports or fiber-optic cable connectors.

Important: Minimum inside bend radius for fiber-optic cable is 25.4 mm (1 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable. Signal attenuation increases with decreased inside bend radii.



4. Remove the five screws which secure the High Power Fiber Optic Interface Circuit Board to the Control Frame.
5. Remove the circuit board from the Control Frame.

Installation

Install the 700S High Power Fiber Optic Interface Circuit Board in reverse order of removal, while referring to Torque Specifications on page 3-1.

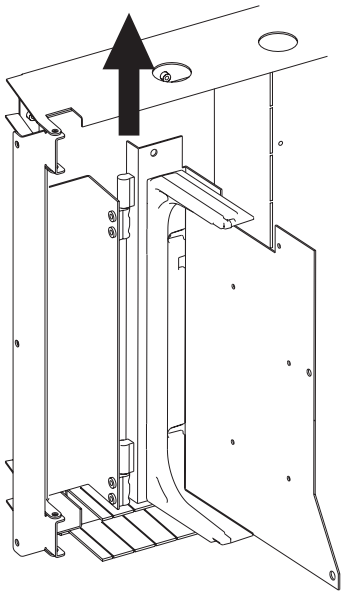
Removing the 700S Control Assembly

Removal

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the 700S Main Control Assembly. Refer to Removing the 700S Control Assembly on page 3-5.

3. Remove the 700S High Power Fiber Optic Interface Circuit Board. Refer to Removing the 700S High Power Fiber Optic Interface Circuit Board on page 3-7.

4. Lift the Control Assembly up and off of the hinge.



Installation

Install the 700S Control Assembly in reverse order of removal.

Removing the 700H I/O Boards and Control Assembly

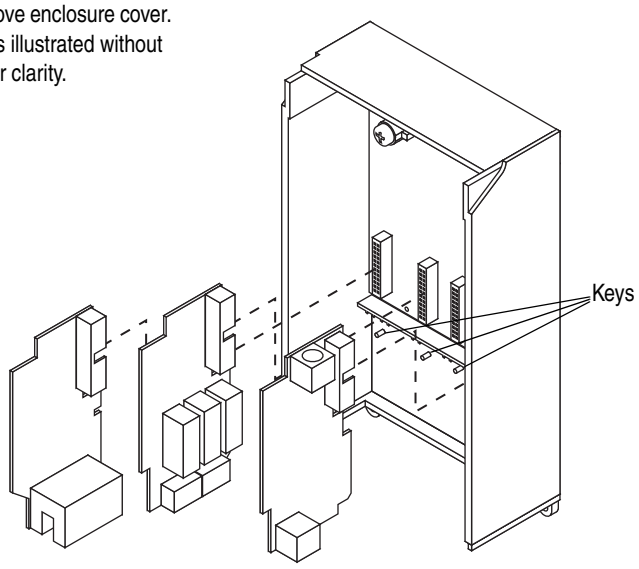
Removal

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.

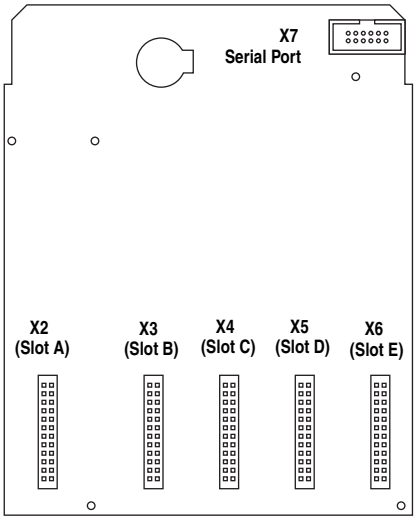
2. Open the enclosure that contains the Control and I/O Boards and carefully unplug the DPI cable and any I/O cables.

3. Remove the I/O Boards from the Control Board and enclosure. Note the order of the boards and the keys which prevent placement of boards in the incorrect slots.

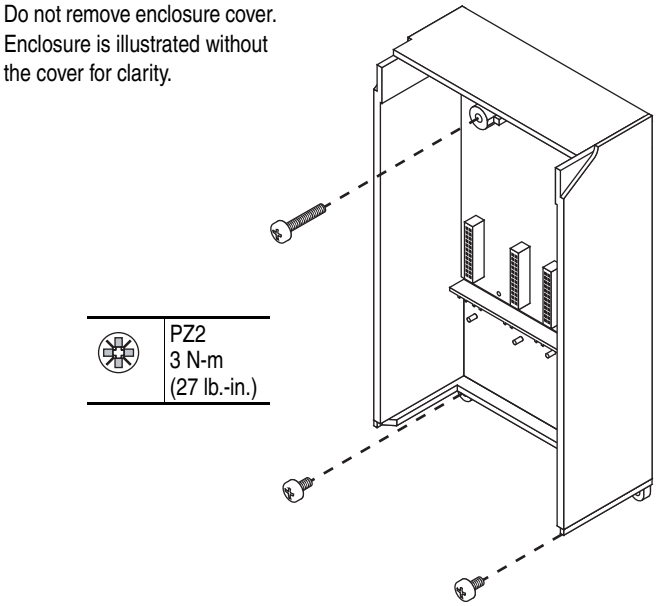
Do not remove enclosure cover. Enclosure is illustrated without the cover for clarity.



4. Unplug the serial connection from X7 of the Control Board.



5. Remove the three screws which secure the Control Assembly to the drive.



6. Remove the Control Assembly.

Installation

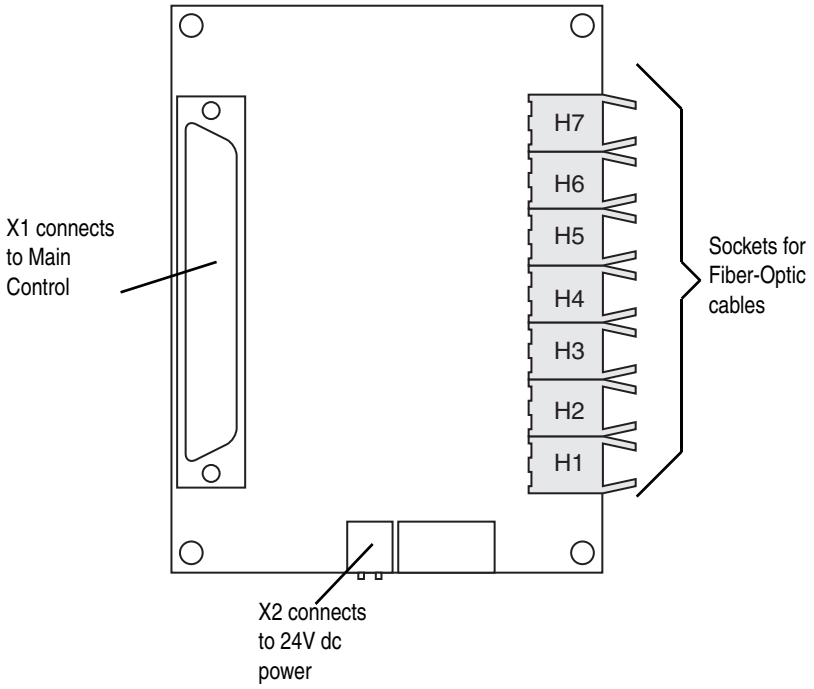
Install the 700H Control and I/O Boards in reverse order of removal, while referring to Torque Specifications on page 3-1.

Removing the 700H Fiber Optic Adapter Board

Removal

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the I/O boards and Control Assembly. Refer to Removing the 700H I/O Boards and Control Assembly on page 3-9.
3. Move the Control Frame to expose its back, while referring to Removing the Covers from the Power Structure on page 3-13.

4. Disconnect the control power cable from X2 of the Fiber Optic Adapter Board.

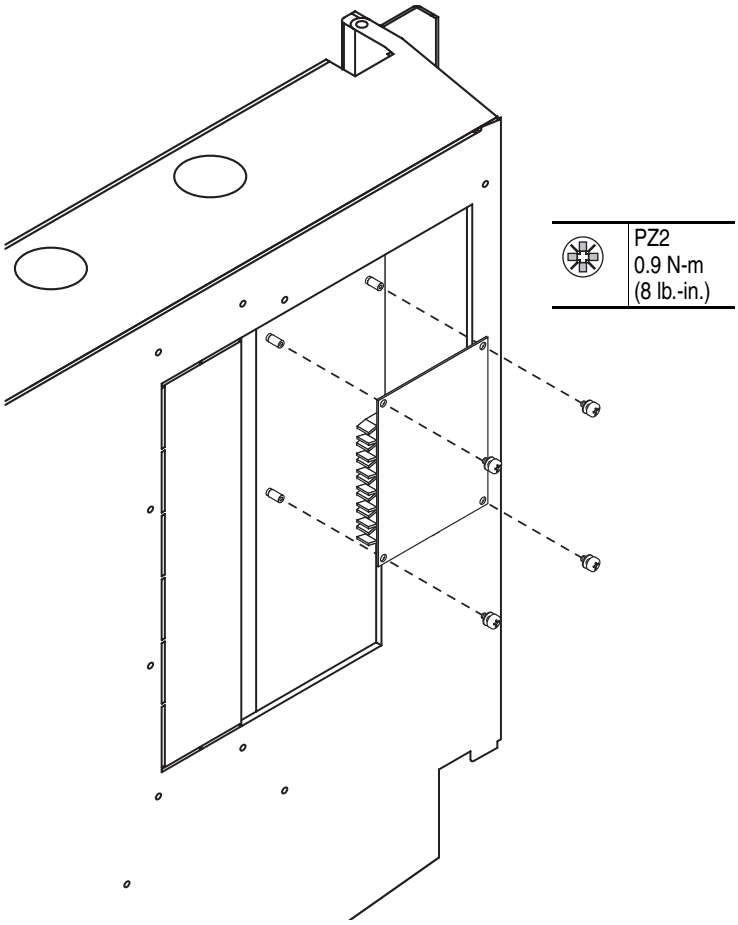


5. Carefully disconnect the fiber-optic cables from the right side of the circuit board, and carefully set them aside.

ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into fiber-optic ports or fiber-optic cable connectors.

Important: Minimum inside bend radius for fiber-optic cable is 25.4 mm (1 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable. Signal attenuation increases with decreased inside bend radii.

6. Remove the four screws which secure the Fiber Optic Adapter board to the stand-offs on the back of the Control Frame.



7. Remove the Fiber Optic Adapter Board from the Control Frame.

Installation

Install the 700H Fiber Optic Adapter Board in reverse order of removal, while referring to Torque Specifications on page 3-1.

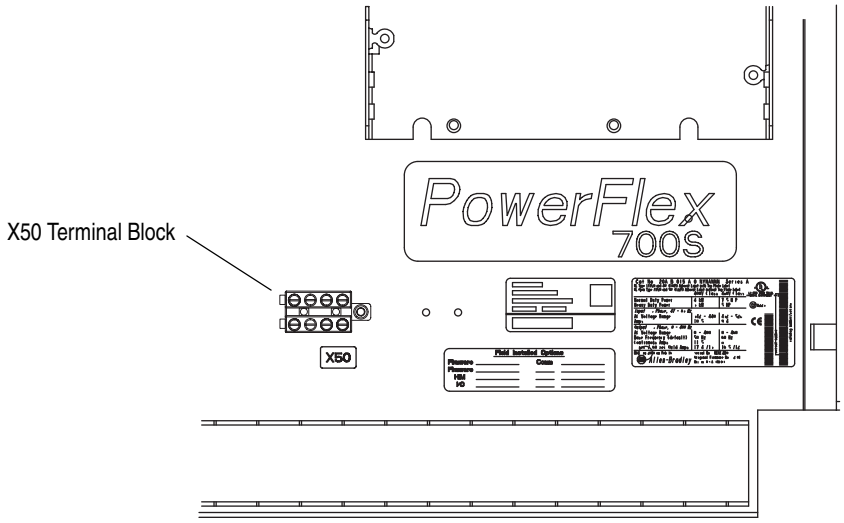
Removing the Covers from the Power Structure

Moving the Control Frame

Removal

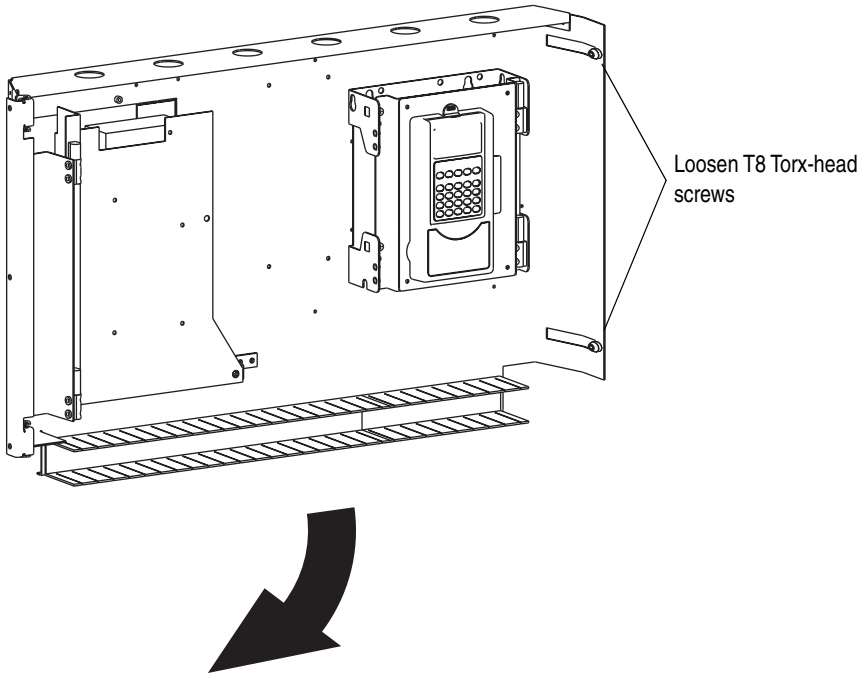
1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.

2. If moving the control frame from a DC input drive with precharge interlock, disconnect the wiring from terminal strip X50.



3. Loosen the T8 Torx-head screws, which secure the Control Frame to the drive enclosure.

4. Swing the Control Frame out and away from the power structure.



Installation

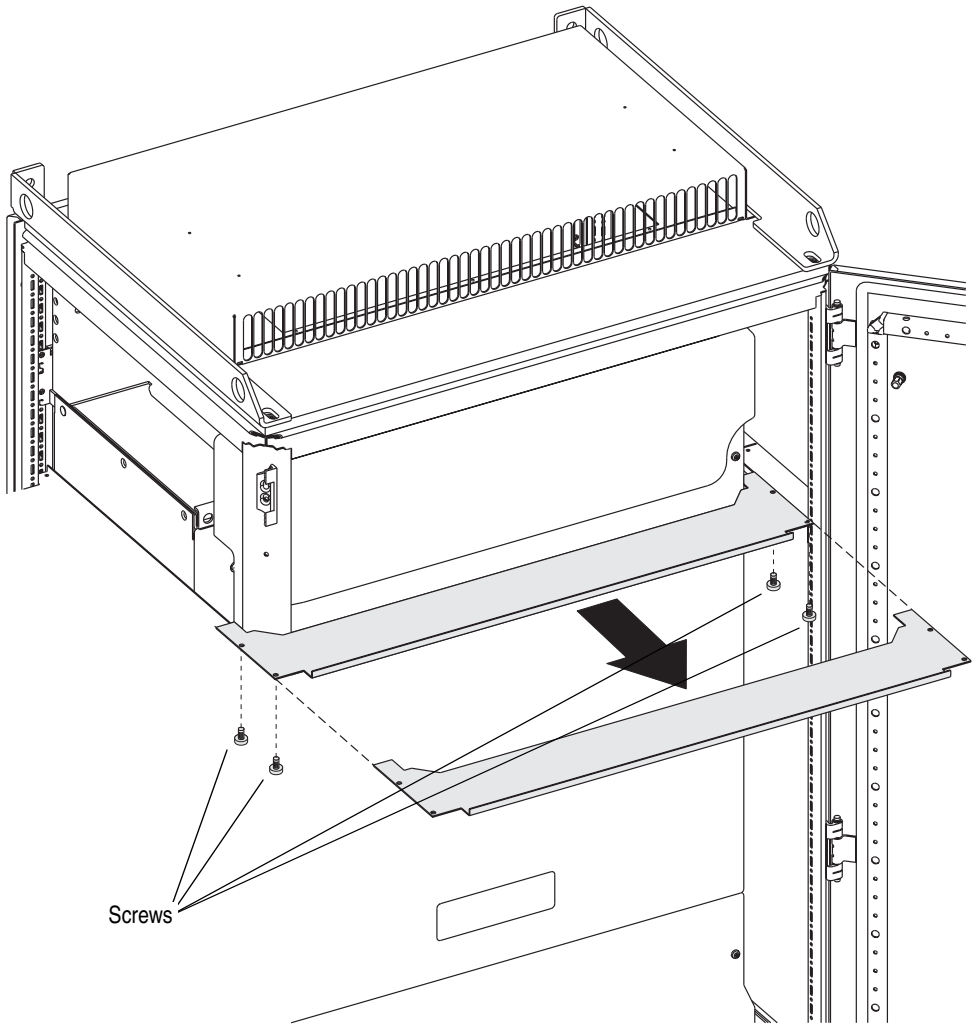
Install the Control Frame in reverse order of removal, while referring to Torque Specifications on page 3-1.

Removing the Airflow Plate

The drive is equipped with a plate, just above the Control Frame, that manages airflow through the drive. You must remove this plate in order to access the protective covers.

Removal

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Move the Control Frame away from the power structure. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Remove the T8 Torx-head screws which secure the airflow plate to the drive.
4. Slide the airflow plate off of drive.



Installation

Install the Airflow Plate in reverse order of removal, while referring to Torque Specifications on page 3-1.

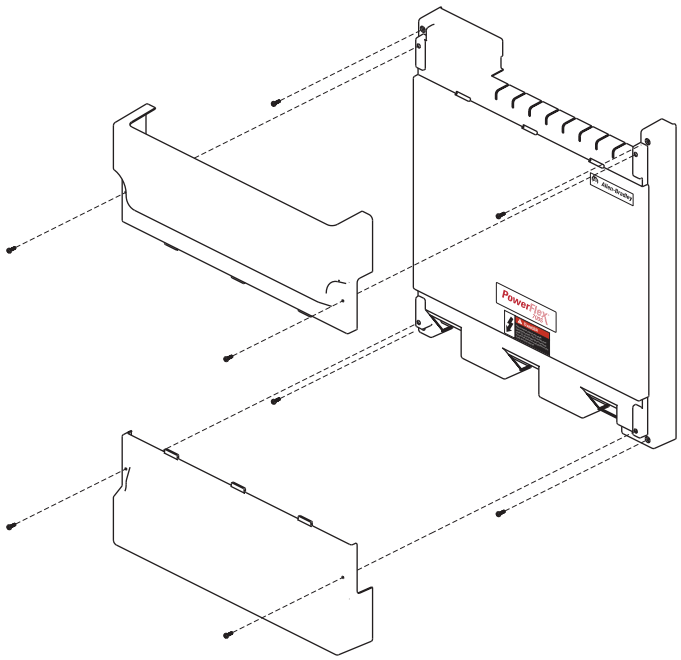
Removing the Protective Covers from Power Structure

You must remove the protective covers to gain access to the power structure.

Removal

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Move the Control Frame away from the power structure. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Remove the Airflow Plate. Refer to Removing the Airflow Plate on page 3-15.
4. Remove the four M5 POZIDRIV screws, which secure the top and bottom protective covers to the main front protective cover, then remove the top and bottom protective covers.

   Note: *you only need to remove the top and bottom covers to gain access to the power terminals. You can remove the other covers without removing the top and bottom ones.*
5. Remove the four M5 POZIDRIV screws, which secure the main front protective cover to the drive, then remove the protective cover.



Installation

Install the Protective Covers in reverse order of removal, while referring to Torque Specifications on page 3-1.

Removing the 700S Voltage Feedback Circuit Board

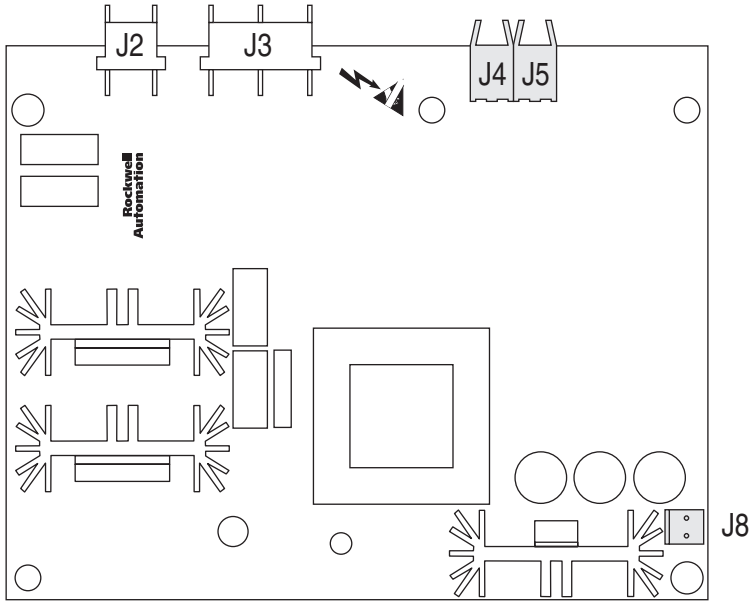
Removal

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the covers from the power structures. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Carefully disconnect the fiber-optic cables from J4 and J5 sockets at the top of the Voltage Feedback Circuit Board, and carefully set them aside.

ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into fiber-optic ports or fiber-optic cable connectors.

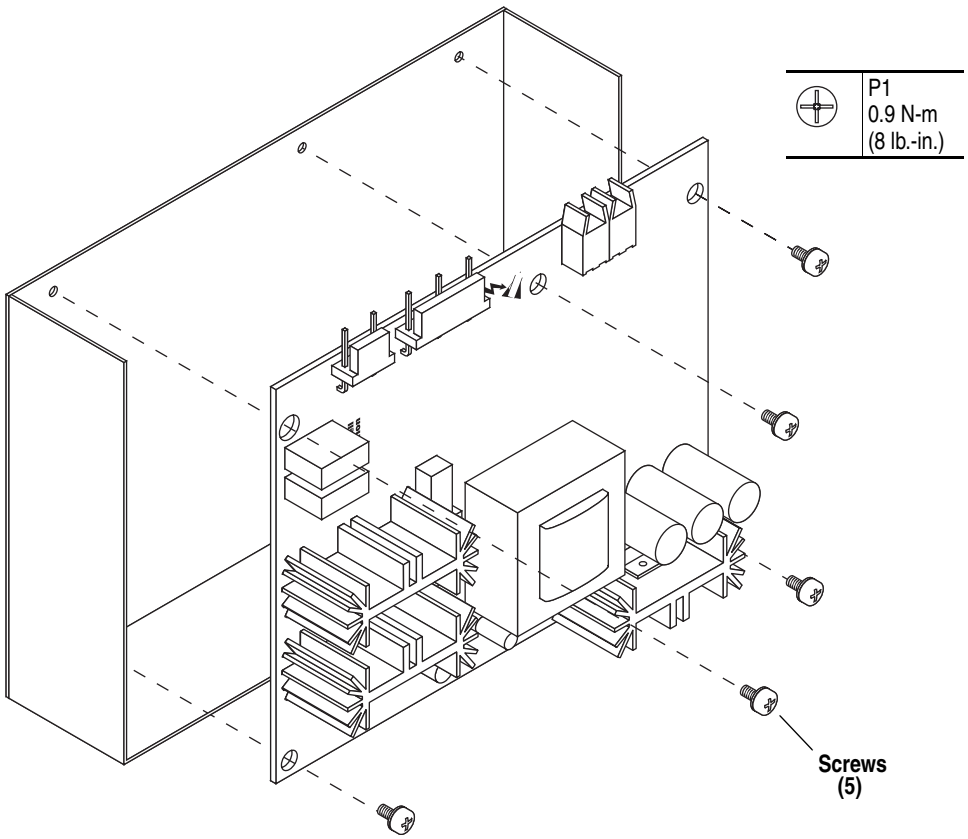
Important: Minimum inside bend radius for fiber-optic cable is 25.4 mm (1 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable. Signal attenuation increases with decreased inside bend radii.

4. Disconnect the DC bus connection cable from the J2 socket and the motor feedback connection cable from the J3 socket at the top of the Voltage Feedback Circuit Board.
5. Disconnect the cable from J8 socket of the Voltage Feedback Circuit Board, and set it aside.



6. Remove the five screws which secure the Voltage Feedback Circuit Board to the drive.

7. Remove the circuit board from the drive.



Installation

Install the 700S Voltage Feedback Circuit Board in reverse order of removal, while referring to Torque Specifications on page 3-1.

Removing the Gate Driver Board

Removal

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.

2. Remove the covers from the power structures. Refer to Removing the Covers from the Power Structure on page 3-13.

3. Disconnect the DC +/- supply from X1 of the Gate Driver Board.

4. Carefully disconnect the fiber-optic cables from sockets along the top of the Gate Driver Board, and carefully set them aside.

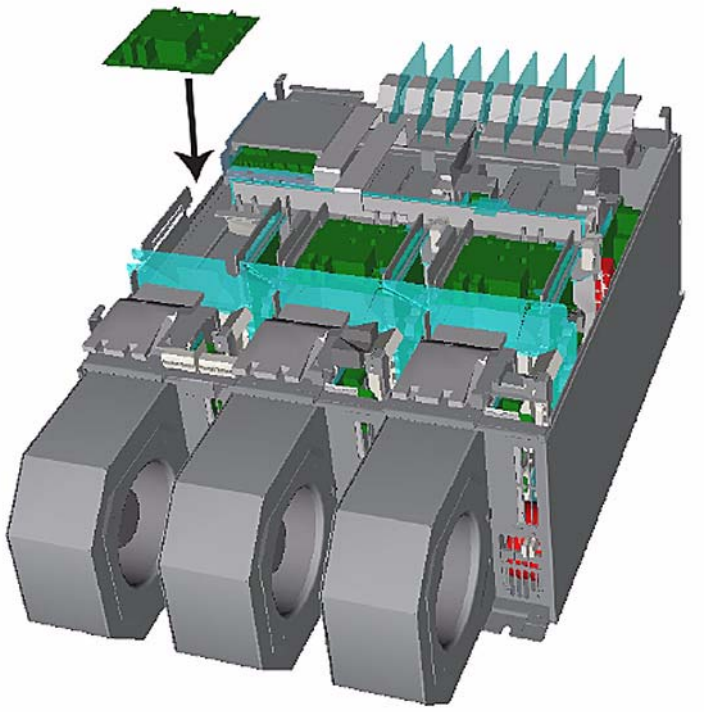
ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into fiber-optic ports or fiber-optic cable connectors.

Important: Minimum inside bend radius for fiber-optic cable is 25.4 mm (1 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable. Signal attenuation increases with decreased inside bend radii.

5. Remove the two screws on the right side of the Gate Driver Board that secure the clear plastic cover.

6. Disconnect the other cables from sockets of the Gate Driver Board, and set them aside.

7. Remove the remaining two screws that secure the Gate Driver Board to the Power module.



8. Carefully remove the board.

Installation

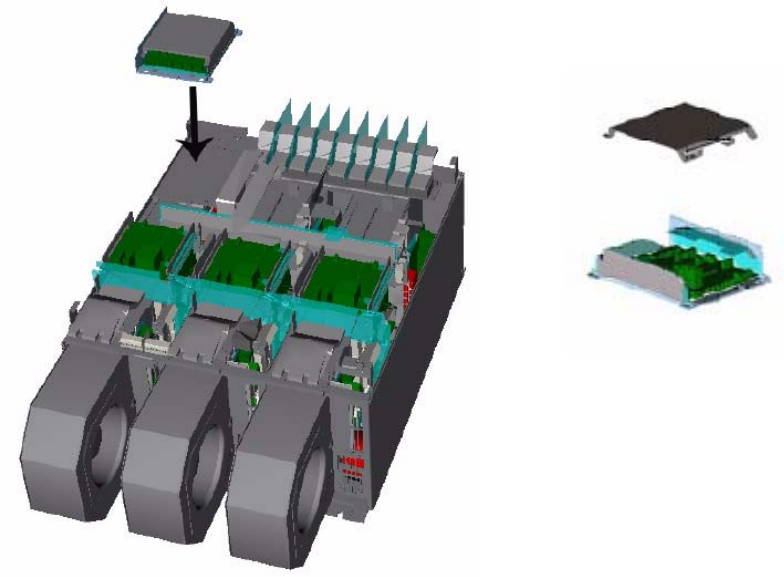
1. Install the Gate Driver Board in the reverse order of removal.

Removing the ASIC Board

Removal

ATTENTION: The sheet metal cover and mounting screws on the ASIC Board located on the power structure are energized at (-) DC bus potential high voltage. Risk of electrical shock, injury, or death exists if someone comes into contact with the assembly.

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the covers from the power structures. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Remove the cover from the ASIC assembly and the -DC bus connection from the cover.

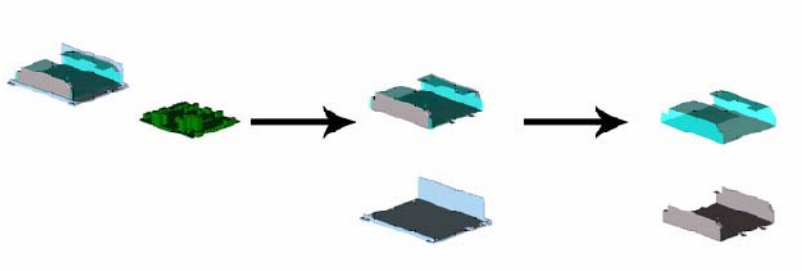


4. Unplug the fan, which mounts on the cover, from connector X1 of the ASIC board.
5. Carefully disconnect the fiber-optic cables from sockets of the ASIC Board, and carefully set them aside.

ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into fiber-optic ports or fiber-optic cable connectors.

Important: Minimum inside bend radius for fiber-optic cable is 25.4 mm (1 in.). Any bends with a shorter inside radius can permanently damage the fiber-optic cable. Signal attenuation increases with decreased inside bend radii.

6. Disconnect the other cables from sockets on the front of the ASIC Board, and set them aside.
7. Remove the fan from the ASIC Board.
8. Slide the ASIC Board out of the assembly chassis.
9. Remove the ASIC assembly chassis from the mounting plate.
10. Remove the plastic board holder.



Installation

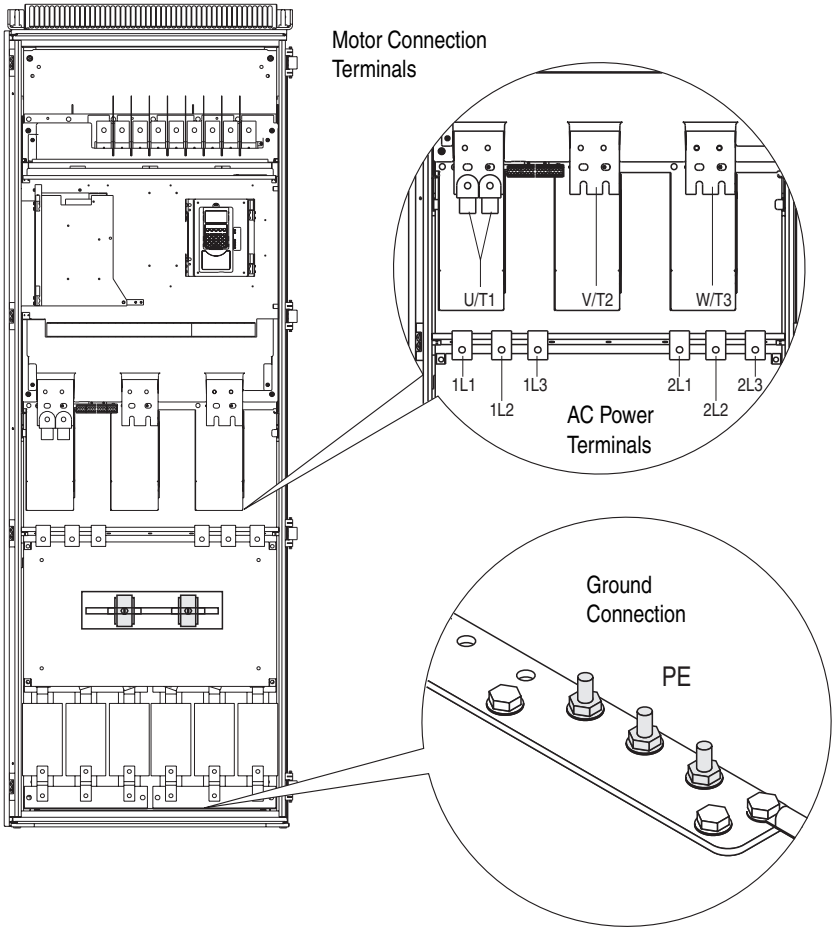
Install the ASIC Board in reverse order of removal, while referring to Torque Specifications on page 3-1. Reconnect cables to ASIC Board, while referring to Figure B.10 on page B-11 or Figure B.7 on page B-8).

Removing the Power Structure from the Drive Cabinet

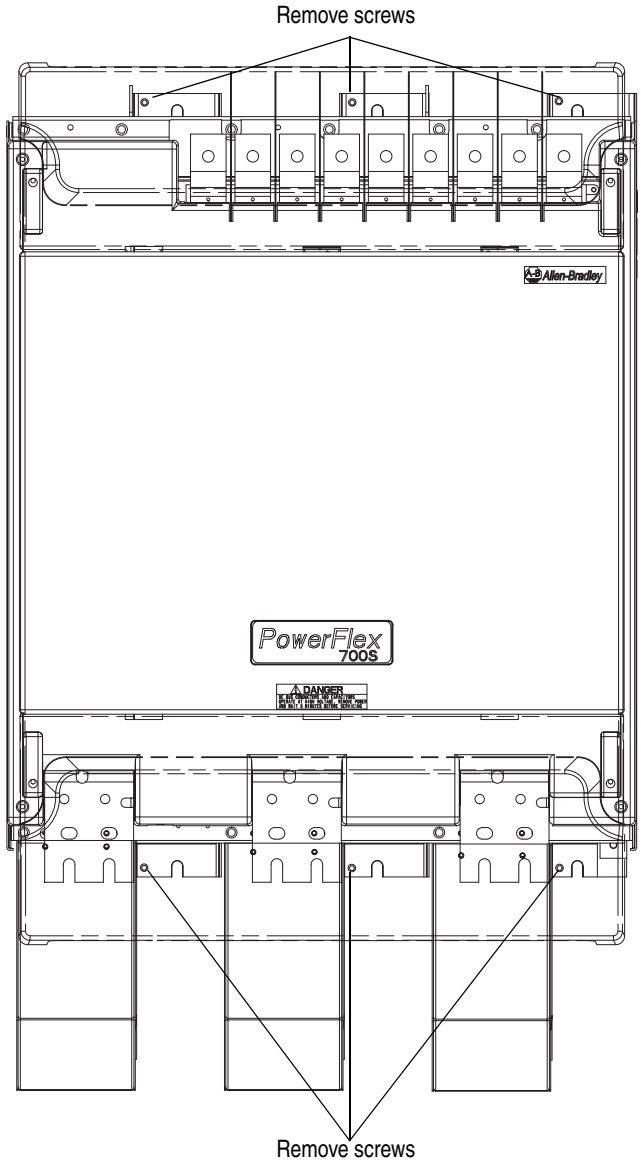
Removal

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the covers from the power structures. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Remove the motor wiring from the power structure at the front of the power structure.
4. Remove the ground connection from the lower right corner of the power structure.

5. Remove the input (AC or DC) and brake wiring (if equipped) from the incoming terminals at the top of the power structure.



6. Remove the six screws that secure the Power Structure to the enclosure frame.



7. Follow the instructions in publication PFLEX-IN014, *Installation Instructions - PowerFlex 700S /700H High Power Maintenance Stand*, to install the Maintenance Stand. Remove the power structure by sliding it onto the rails of the Maintenance Stand.

Note: *The Maintenance Stand is designed for removing power structures from drives supplied in Rittal TS8 enclosures. Alternate means of removal will be necessary for other types of enclosures.*

Installation

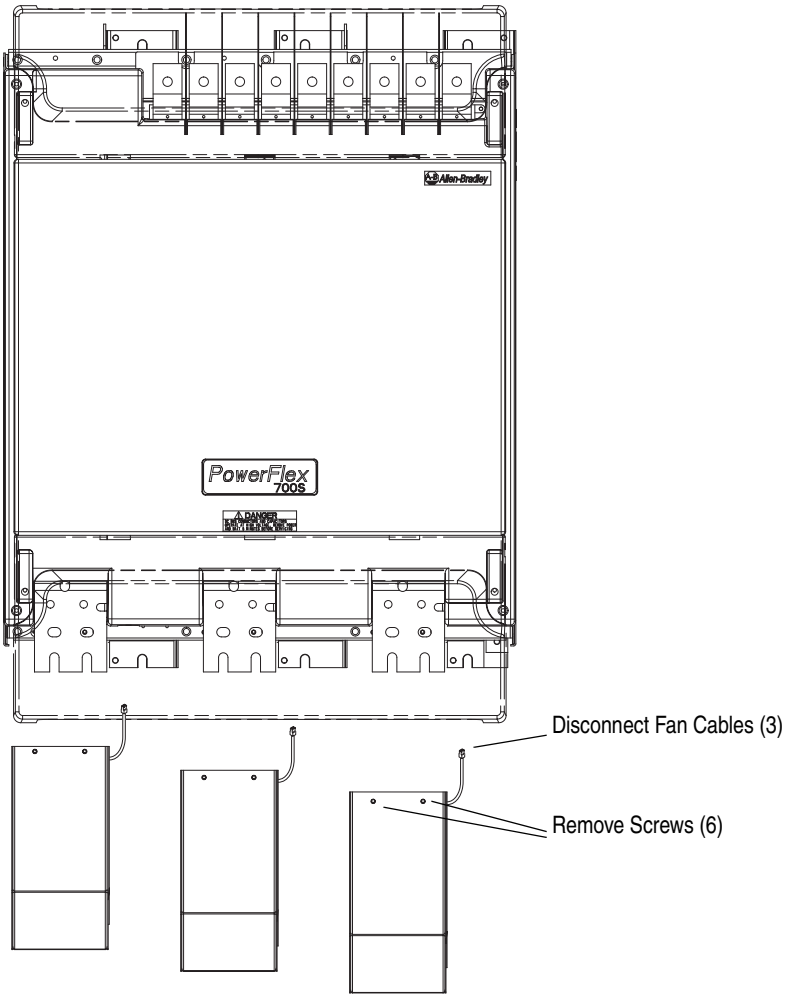
Install the power structure in reverse order of removal, while referring to Torque Specifications on page 3-1. Refer to the publication PFLEX-IN006…, *Installation Instructions - PowerFlex 700S and 700H High Power Drives*, for tightening torques of motor terminations.

Removing the Main Fans

Removal

There are three main fans on the drive.

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the bottom protective cover from the power structure. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Disconnect the fan cable connectors under the power structure.
4. Remove the two screws which secure each fan to the drive. Then remove the fans.



Installation

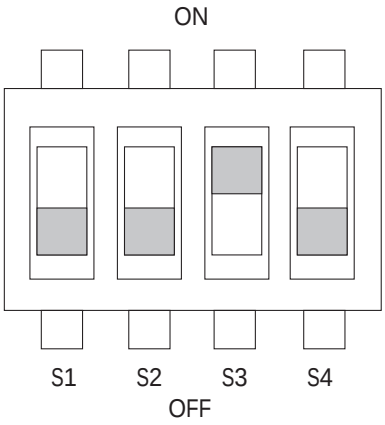
Install the fans in reverse order of removal, while referring to Torque Specifications on page 3-1.

Removing the Fan Inverters

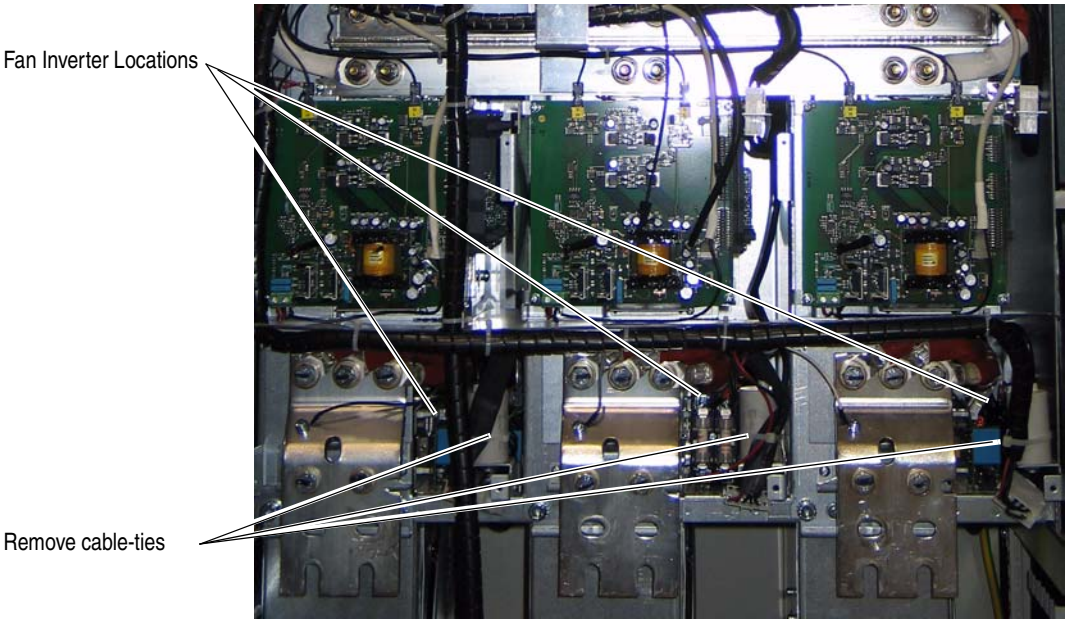
Removal

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the covers from the power structures. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Remove the power structure from the drive cabinet. Refer to Removing the Power Structure from the Drive Cabinet on page 3-21.
4. Verify the following default DIP switch settings.

Switch	Setting	To indicate the following:
S1	Off	50 Hz fan motor frequency
S2	Off	220 V ac motor voltage
S3	On	230 V ac motor voltage
S4	Off	Frame size 9 - 13



5. Remove the cable-ties that secure the cables with black insulation to the fan inverter assemblies. This will allow you to move the cables and remove the inverter assemblies.

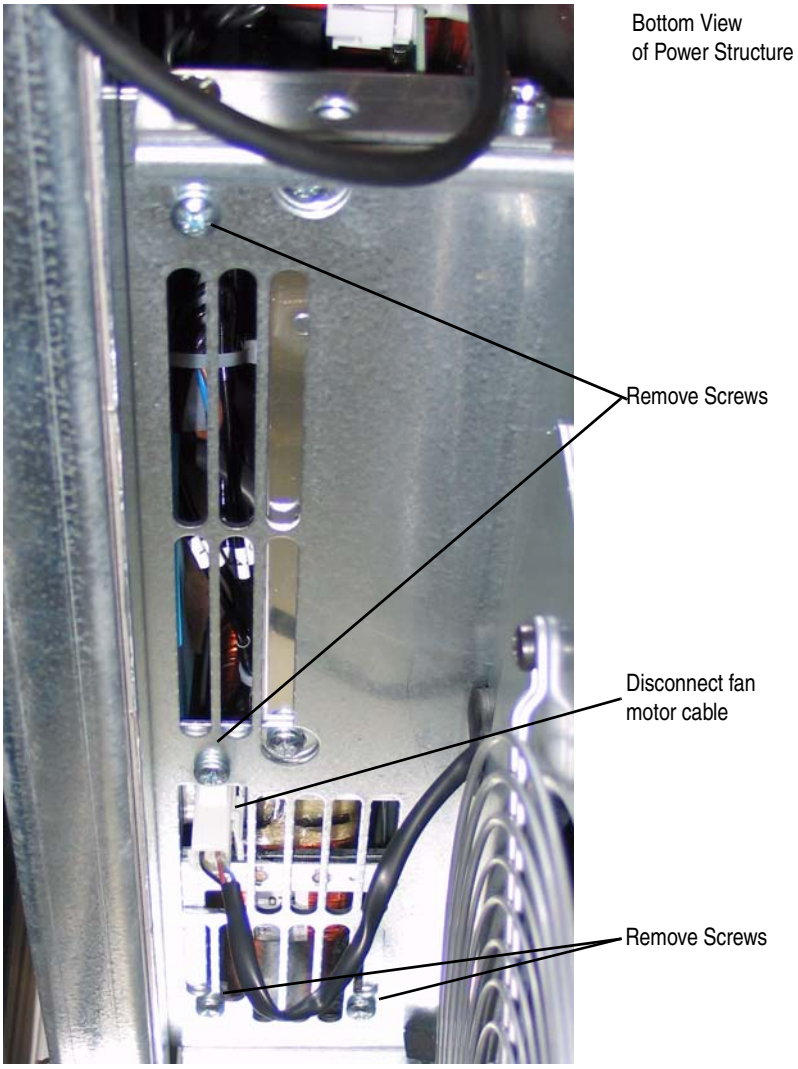


6. Disconnect the fan motor cable under the inverter.

7. Remove the four M5 POZIDRIV screws, which secure the bottom of the fan inverter to the drive. Proper tightening torque for reassembly is 4 N-m (35 lb.-in.).

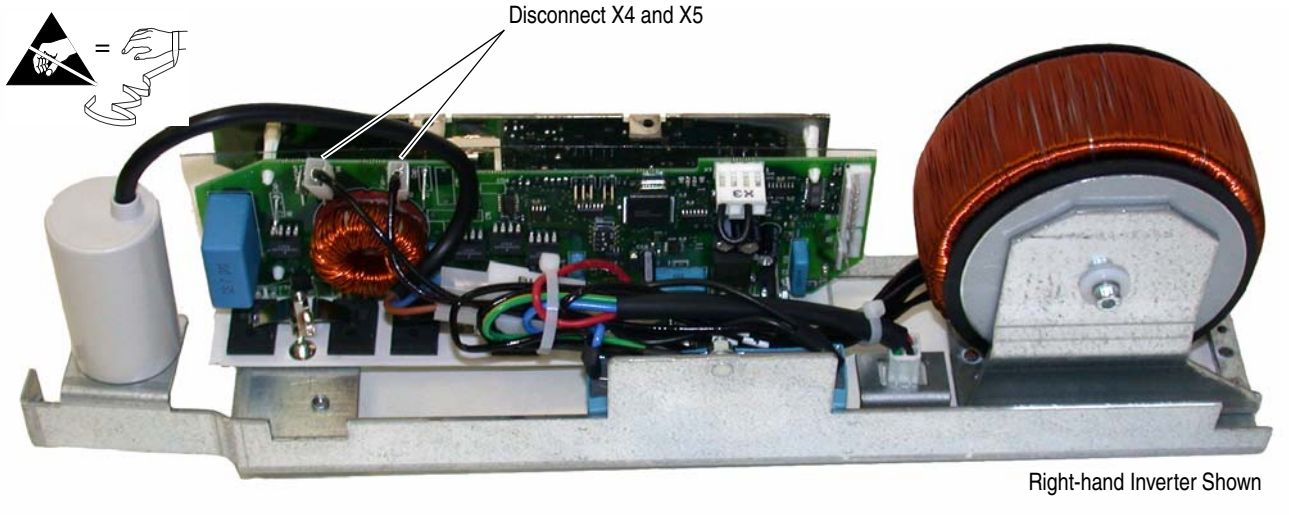
8. Disconnect the cables at X2, X8 and X3 (on left-hand and center inverters); and X2 and X8 (on right-hand inverter).

9. Carefully remove the inverters by sliding them out toward the front of the drive.



Important: Do not damage the output transformer when removing or installing the inverter.

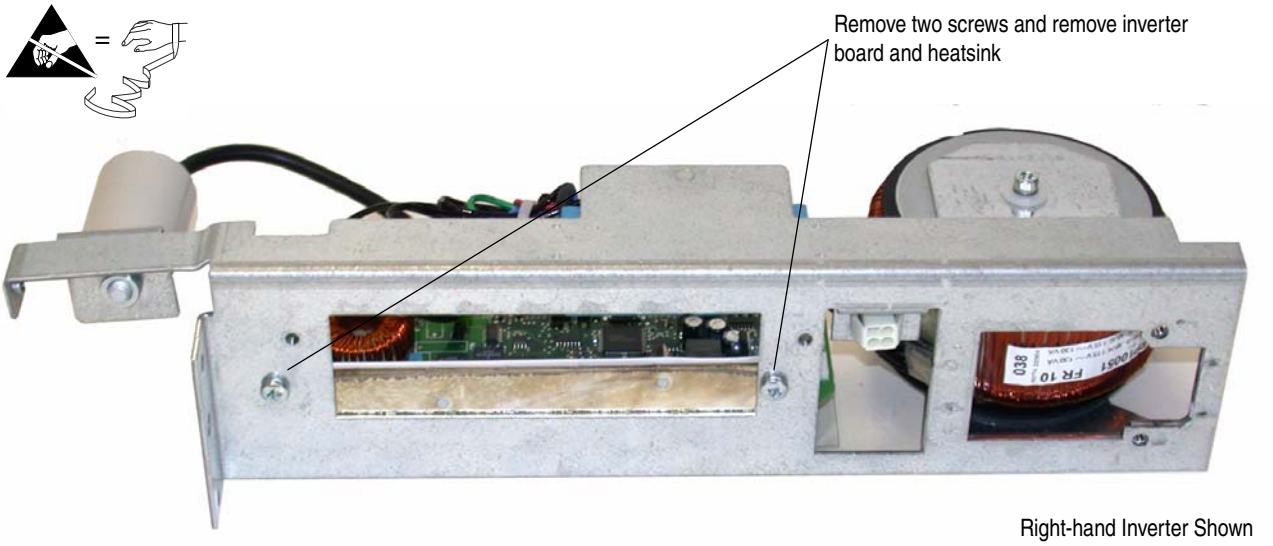
10. To remove the inverter from the old inverter assembly, disconnect the cables at connectors X4 (Blue) and X5 (Black).



Right-hand Inverter Shown

11. Remove two M5 POZIDRIV screws, which secure the inverter board and its heatsink to the assembly carriage. Proper tightening torque for reassembly is 4 N-m (35 lb.-in.).

12. Carefully remove the inverter board and its heatsink from the assembly carriage.



Right-hand Inverter Shown

Installation

Install the fan inverters in reverse order of removal, while referring to Torque Specifications on page 3-1.

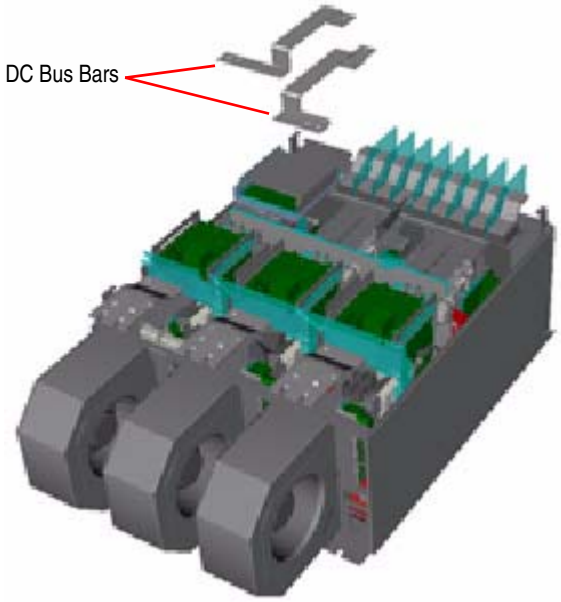
Removing the U Phase (Left-Side) Output Power Module

Removal

Important: Do not attempt to disassemble the Output Power Module.

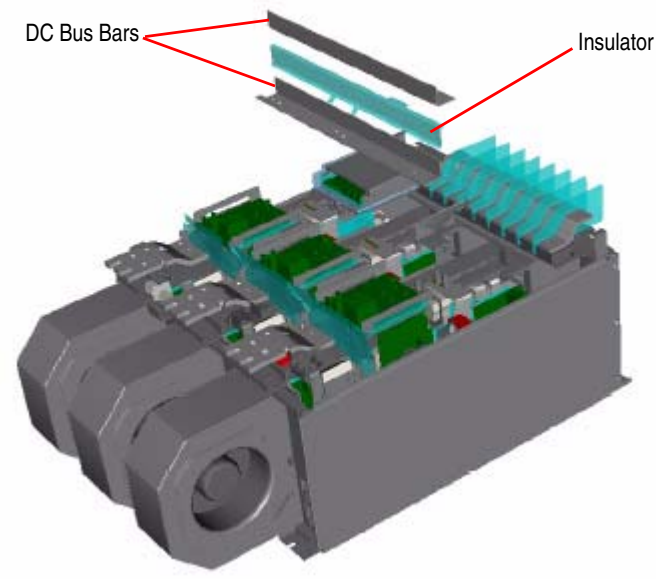
Important: Always replace all three Output Power Modules (do not replace just one module).

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the covers from the power structures. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Remove the power structure from the drive cabinet. Refer to Removing the Power Structure from the Drive Cabinet on page 3-21.
4. Disconnect the output leads from the bottom of the Output Power Module.
5. Remove the screws that secure the DC Bus Bars connecting the Input Power Terminals to the Main DC Bus Bars and remove the Bus Bars.



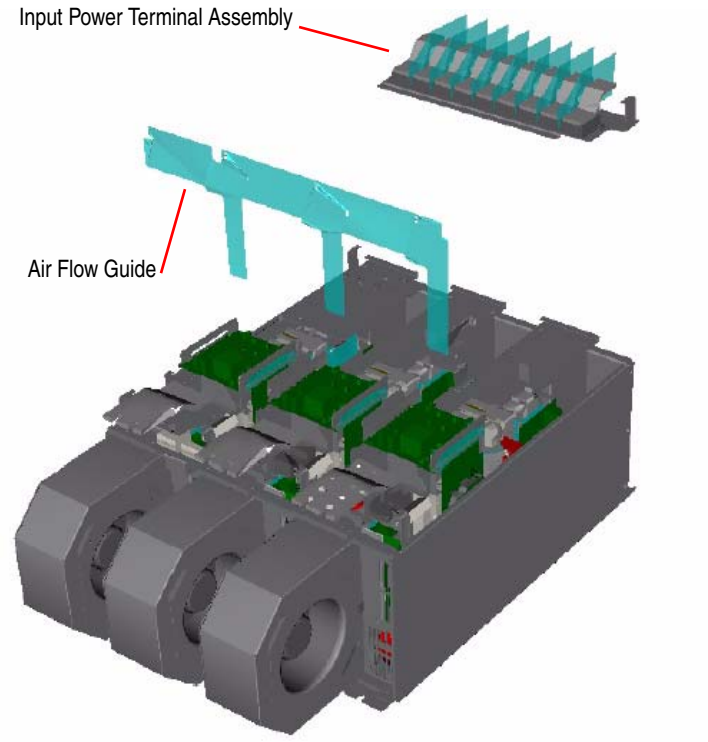
6. Disconnect the rectifying circuit wiring from the Main DC Bus Bars.

7. Remove the screws that secure the Main DC Bus Bars to the Power Structure and remove the Main Bus Bars.



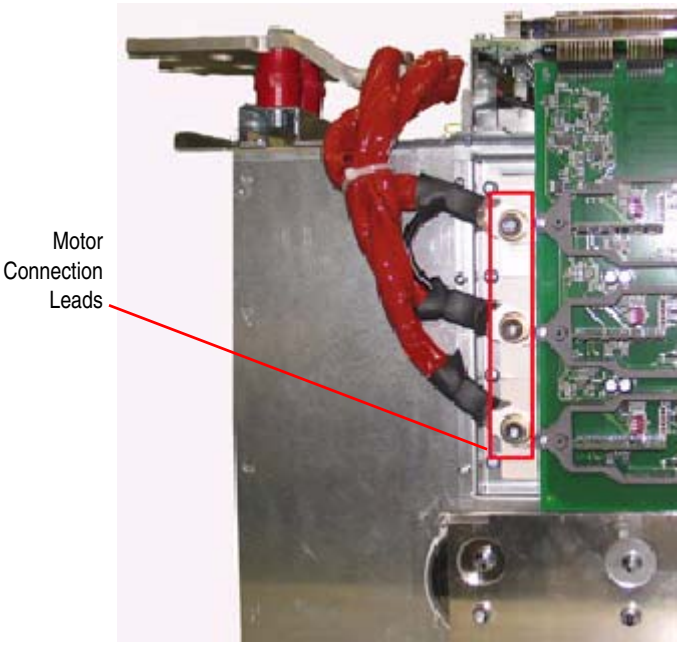
8. Remove the screws that secure the Input Power Terminal assembly to the Power Structure and remove the Input Power Terminal assembly.

9. Remove the screws that secure the Air Flow Guide to the Power Structure and remove the Air Flow Guide.



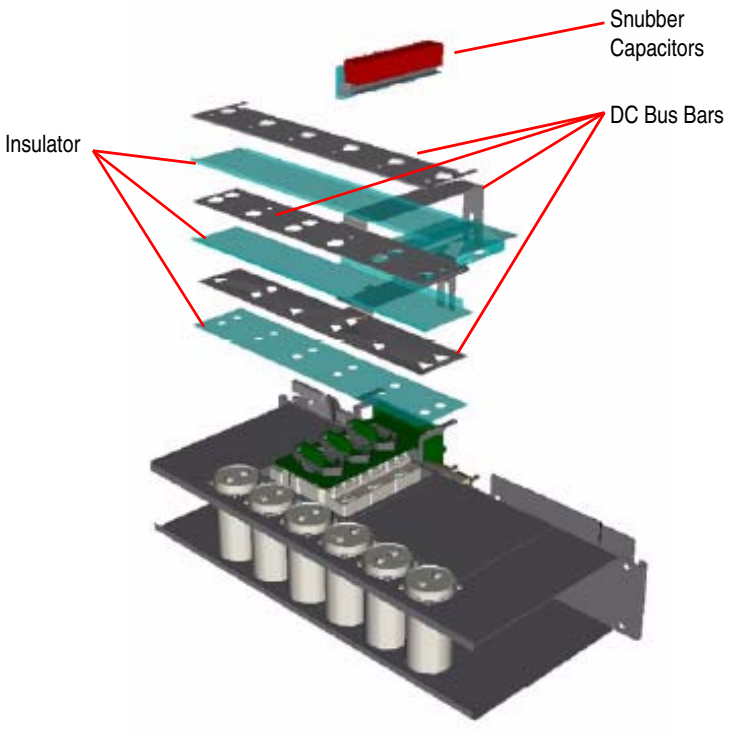
10. Remove the screws that secure the U Phase (left side) Power assembly to the drive and remove the Power assembly.

11. Remove the screws that secure the motor connection leads to the Power Module assembly and remove the motor connection leads.

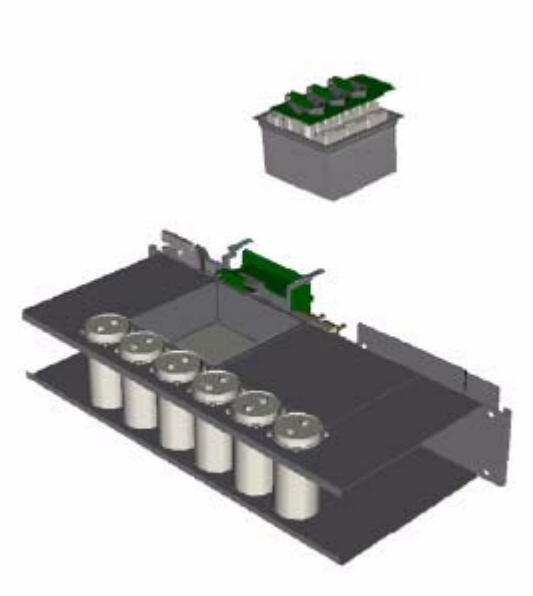


12. Remove the screws that secure the Snubber Capacitors and remove the Snubber Capacitors.

13. Remove the screws that secure the DC Bus Bars to the U Phase (left side) power module and remove the DC Bus Bars.



14. Remove the screws which secure the Output Power Module to the drive.
15. Disconnect the Power Module Circuit Board from the Adapter Board.
16. Remove the Output Power Module from the drive.



Installation

Install the Output Power Module in reverse order of removal, while referring to Torque Specifications on page 3-1.

Removing the V Phase (Middle) Rectifying Board, Rectifying Module and Output Power Module

Removal

Important: Do not attempt to disassemble the Output Power Module.

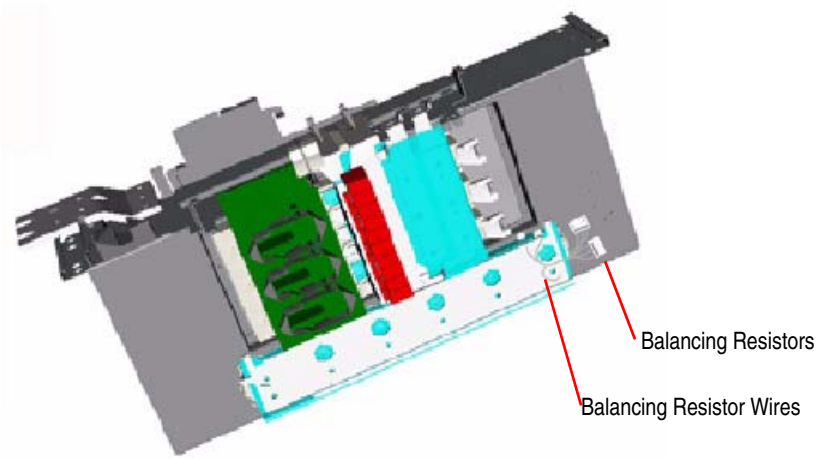
Important: Always replace all three Output Power Modules (do not replace just one module).

Important: 600V ac input, 460A and 502A frame 11 drives only have one Rectifying module. The Rectifying module is contained in the W Phase (right) Power assembly.

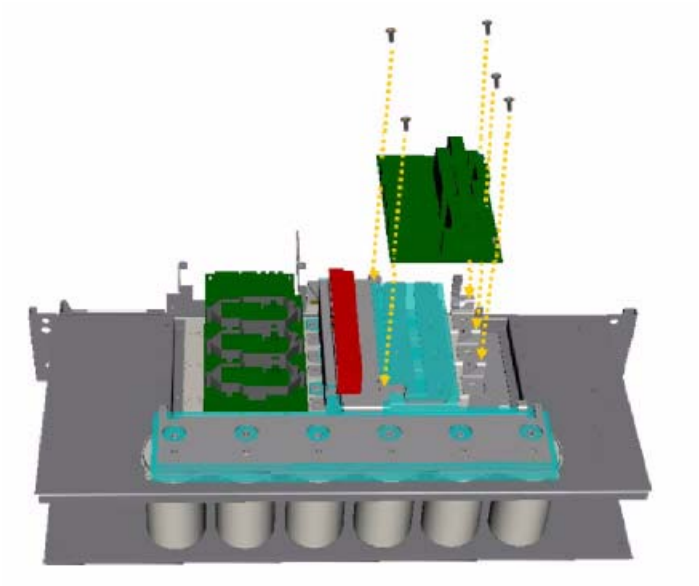
1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.
2. Remove the covers from the power structures. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Remove the power structure from the drive cabinet. Refer to Removing the Power Structure from the Drive Cabinet on page 3-21.
4. Disconnect the output leads from the bottom of the Output Power Module.
5. Remove the screws that secure the V Phase (middle) Power assembly to the drive and remove the Power assembly.
6. Disconnect all the wiring from the Rectifying Board and carefully set it aside.

Important: For 690V 460A and 502A units, the X50 Jumper must be removed from the Rectifying Board.

7. Remove the balancing resistor wires from bus bars.
8. Disconnect the cables from the AC input terminals on the Rectifying Module.

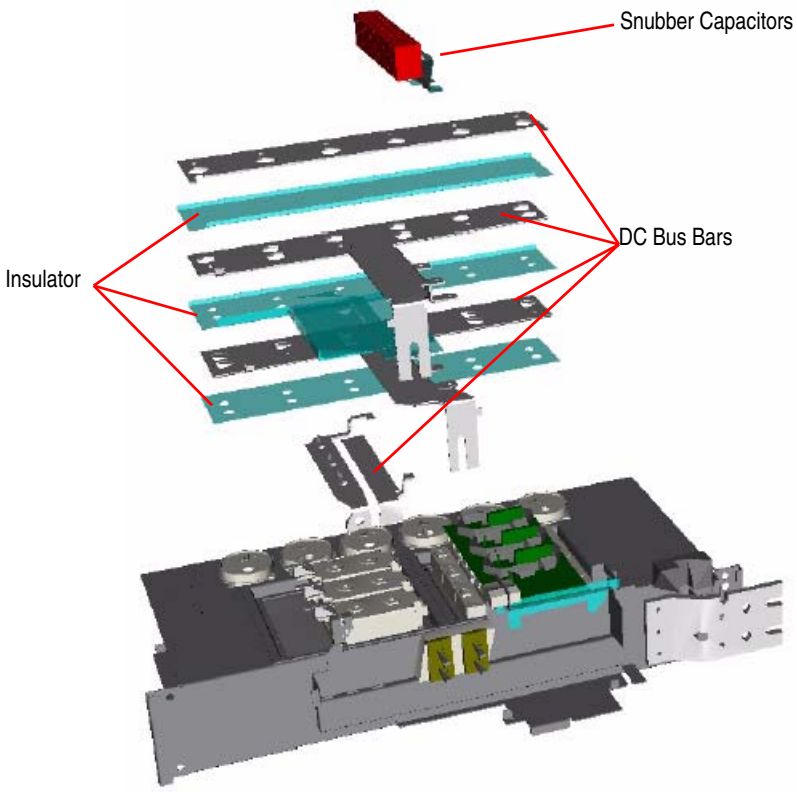


9. Remove the five screws that secure the Rectifying Circuit Board to the drive and remove the Rectifying Circuit Board.



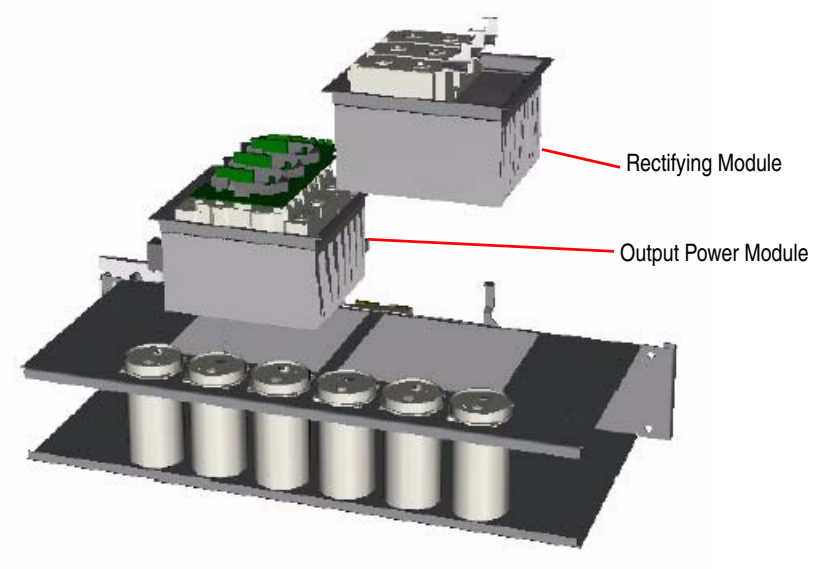
10. Remove the screws that secure the Snubber Capacitors and remove the Snubber Capacitors.

11. Remove the screws that secure DC Bus Bars to right side of power structure, and remove the DC Bus Bars.



12. Remove the screws that secure the Rectifying Module to the power structure and remove the Rectifying Module.

13. Remove the screws that secure the Output Power Module to the power structure, and remove the Output Power Module.



Installation

Install the Output Power Module in reverse order of removal, while referring to Torque Specifications on page 3-1.

Removing the W Phase (Right-Side) Rectifying Board, Rectifying Module and Output Power Module

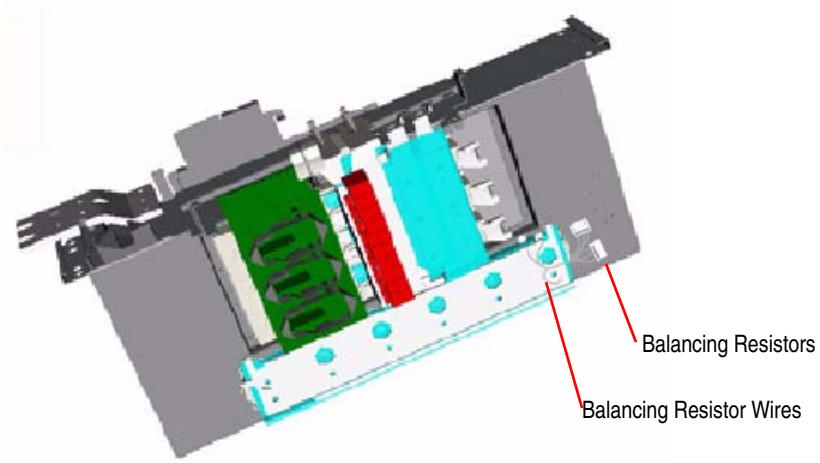
Important: Do not attempt to disassemble the Output Power Module.

Important: Always replace all three Output Power Modules (do not replace just one module).

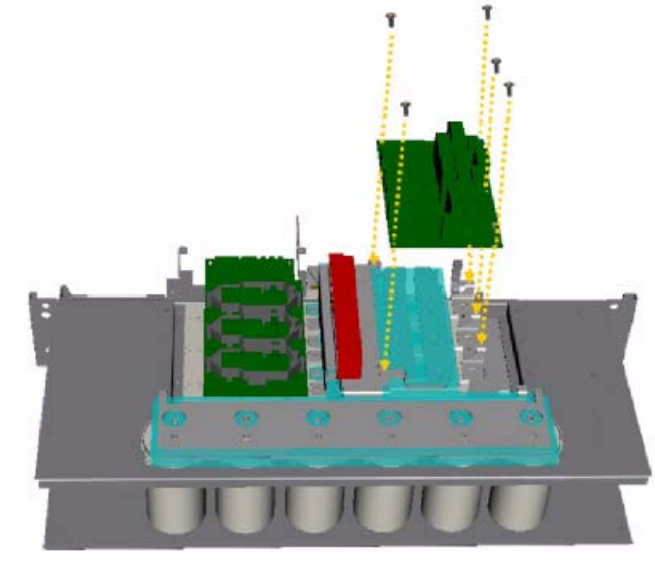
1. Remove power from the drive (Removing Power from the Drive on page 3-3).
2. Remove the covers from the power structures. Refer to Removing the Covers from the Power Structure on page 3-13.
3. Remove the power structure from the drive cabinet (Removing the Power Structure from the Drive Cabinet on page 3-21).
4. Disconnect the output leads from the bottom of the Output Power Module.
5. Remove the screws that secure the W Phase (right-side) Power assembly to the drive and remove the Power assembly.

Important: For 690V 460A and 502A units, the W Phase (right-side) Power assembly does not have a Rectifying Module.

6. Disconnect all the wiring from the Rectifying Board and carefully set it aside.
7. Remove the balancing resistor wires from bus bars.
8. Disconnect the cables from the AC input terminals on the Rectifying Module.

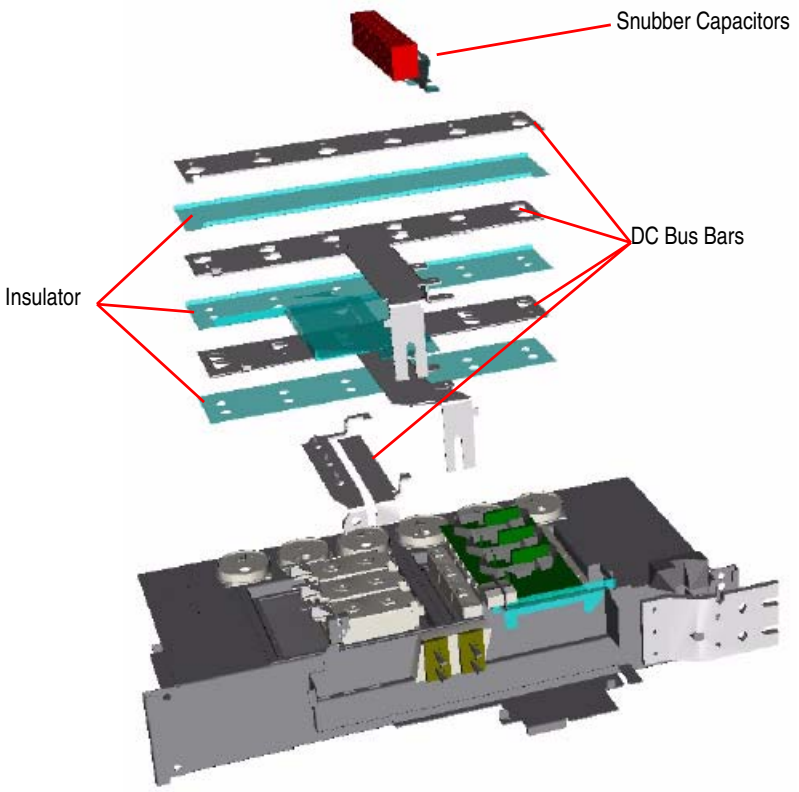


9. Remove the five screws that secure the Rectifying Circuit Board to the drive and remove the Rectifying Circuit Board.



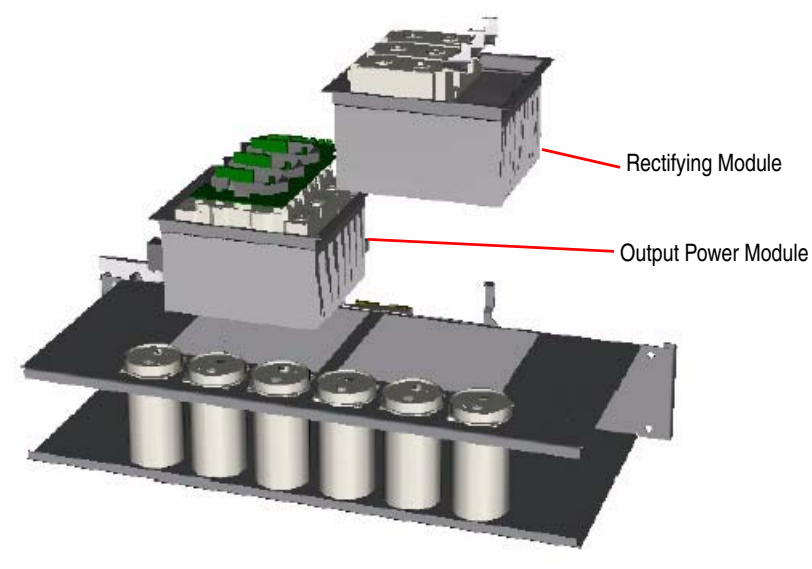
10. Remove the screws that secure the Snubber Capacitors and remove the Snubber Capacitors.

11. Remove the screws that secure DC Bus Bars to right side of power structure, and remove the DC Bus Bars.



12. Remove the screws that secure the Rectifying Module to the power structure and remove the Rectifying Module.

13. Remove the screws that secure the Output Power Module to the power structure, and remove the Output Power Module.



Installation

Install the Output Power Module in reverse order of removal, while referring to Torque Specifications on page 3-1.

Removing the DC Bus Capacitors

Removal

1. Remove power from the drive. Refer to Removing Power from the Drive on page 3-3.

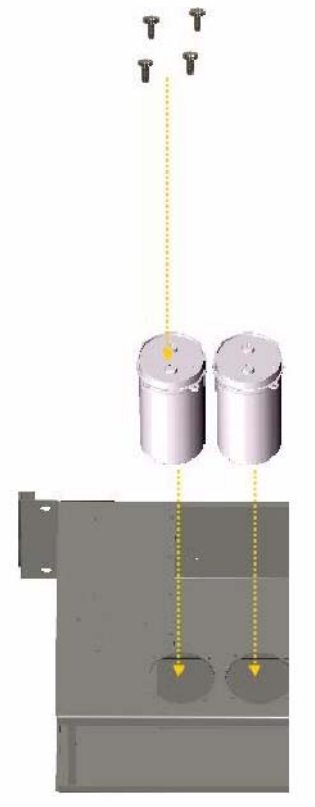
2. Remove the covers from the power structures. Refer to Removing the Covers from the Power Structure on page 3-13.

3. Remove the power structure from the drive cabinet. Refer to Removing the Power Structure from the Drive Cabinet on page 3-21.

4. Remove the Rectifying Module and Output Power Module. Refer to Removing the U Phase (Left-Side) Output Power Module on page 3-29, Removing the V Phase (Middle) Rectifying Board, Rectifying Module and Output Power Module on page 3-33, and Removing the W Phase (Right-Side) Rectifying Board, Rectifying Module and Output Power Module on page 3-36.

Important: It is not necessary to remove the Rectifying Board, Rectifying Module, or Output Power Module in order to remove the DC Bus Capacitors.

5. Remove the four screws that secure the capacitor to the power structure, and remove the capacitor.



Installation

Install the capacitors in reverse order of removal, while referring to Torque Specifications on page 3-1.

Notes:

Start-Up After Repair

ATTENTION: Power must be applied to the drive to perform the following start-up procedure. Some of the voltages present are at incoming line potential. To avoid electric shock hazard or damage to equipment, only qualified service personnel should perform the following procedure. Thoroughly read and understand the procedure before beginning. If an event does not occur while performing this procedure, Do Not Proceed. Remove Power including user supplied control voltages. User supplied voltages may exist even when main AC power is not applied to then drive. Correct the malfunction before continuing.

Phone	United States/ Canada	1.262.512.8176 (7 AM - 6 PM CST) 1.440.646.5800 (24 hour support)
	Outside United States/Canada	You can access the phone number for your country via the Internet: Go to http://www.ab.com Click on *Support* (http://support.rockwellautomation.com/) Under *Contact Customer Support*, click on *Phone Support*
Internet	⇒	Go to http://www.ab.com/support/abdrives/
E-mail	⇒	support@drives.ra.rockwell.com

Be prepared to provide the following information when you contact support:

- Product Catalog Number
- Product Serial Number
- Firmware Revision Level

Before Applying Power to the Drive

1. Check for zero volts between DC+ and DC-.
2. Perform forward and reverse biased diode tests, using a digital multimeter. Refer to Conducting Forward and Reverse Biased Diode Tests for Major Power Components on page 2-4.

Testing with the External DC Power Supply Without Load (Optional)

This is a low current - low risk test for the Output Power Module and drive Control board. It requires the recommended High Voltage DC Test Power Supply.

1. Verify that the DC Test Power Supply is de-energized.
2. Connect the power supply's DC+ to the drive's DC+ terminal and the power supply's DC- to the drive's DC- terminal.
3. Set the power supply voltage setting to zero.
4. Switch on the external DC Test Power Supply.
5. Slowly increase the DC Test Power Supply output voltage to the drive's nominal DC bus voltage (650V dc for drives with 380-500V ac input or 775V dc for drives with 600-690V ac input).
6. Measure the DC bus voltage and verify that the value is reflected in:
   - parameter 306 [DC Bus Voltage] (700S)
   - parameter 012 [DC Bus Voltage] (700H)
7. Make configuration changes which allow the HIM to issue start and speed commands.
8. Make configuration changes which allow operation without an encoder and motor.
9. Start the drive, by pressing (the start button).
10. Increase the speed command from zero to base speed, by pressing (the up button).
11. Stop the drive, by pressing (the stop button).
12. Re-configure the drive to suit the application.
13. Decrease the DC Test Power Supply output voltage to zero. Wait until DC bus voltage has decreased to zero. Switch off the external DC power supply.

Testing Without a Motor

This test allows you to measure several operating parameters and diagnose problems without connecting the motor.

1. Verify that input power wiring and grounding is connected.

1. Verify that the motor cables are disconnected.

2. Energize the drive.

3. Make configuration changes which allow the HIM to issue start and speed commands.

4. Make configuration changes which allow operation without an encoder and motor.

5. Start the drive, by pressing (the start button).

6. Increase the speed command from zero to base speed, by pressing (the up button).

7. Measure the output voltage on each phase and verify that it is balanced. If it is unbalanced troubleshoot the drive.

8. Stop the drive, by pressing (the stop button).

9. Re-configure the drive to suit the application.

Performing the Power Circuit Diagnostic Test on a 700S

The Power Circuit Diagnostic Test, on the 700S, allow you to diagnose problems in the drive's power structure without applying large amounts of power.

1. Verify that input power wiring and grounding is connected.

2. Verify that the motor cables are connected.

3. Energize the drive.

4. From the Monitor menu on the HIM press (the escape button) to navigate to the Main menu.

5. Use (the down button) to move the cursor to the Start-Up selection, and to select Start-Up. Then press again to verify your intention to continue with the Start-Up menu.

6. Use (the down button) to move the cursor to Power Circuit Diagnostics (Pwr Circuit Diag), and to select Power Circuit Diagnostics.

7. Press to begin the Power Circuit Diagnostic routine. Follow indications and instructions on the HIM.

Testing With the Motor

This test allows you to measure several operating parameters and diagnose problems without connecting the motor to its mechanical load.

1. Verify that input power wiring and grounding is connected.
2. Verify that the motor cables are connected.
3. Verify that the motor load is disconnected.
4. Energize the drive.
5. Start the drive and increase the speed from zero to base speed.
6. Measure drive output current and verify that the value is reflected in:
   - parameter 308 [Output Current] (700S)
   - parameter 003 [Output Current] (700H)
7. Stop the drive.

Service Tools and Equipment

Software Tools

DriveTools™ SP, DriveExecutive, DriveExplorer™ and DriveObserver™ are software tools for uploading, downloading and monitoring system parameters.

Service Tools

This list of basic service tools which will cover needs of tools for repair and maintenance measurements.

Item	Description	Details
1	Oscilloscope	Portable, digitizing, dual channel scope, with isolation
2	Current clamp	1000A(ac, rms), signal output
3	Soldering station	Soldering / de soldering
4	Adjustable power supply	0...1300Vdc, 1A, adjustable current limit. Efore LPS 750-HV or equivalent.
5	Adjustable power supply	0...690Vac (+10%), 10A, three phase, galvanic isolation
6	Multi meter	Digital multi meter, capable of ac and dc voltage, continuity, resistance, capacitance measurements, and forward diode bias tests. Fluke model 87 III or equivalent.
7	Insulation tester	1000Vdc
8	Torque wrench	1...12Nm
9	Torque wrench	6...50Nm
10	box wrench	7mm, 8mm, 10mm, 13mm, 17mm, 19mm, 22mm
11	socket extension	230mm
12	Wrench	7mm, 8mm, 10mm, 13mm, 17mm, 19mm, 22mm
13	Wire cutter	
14	Nose pliers	
15	Crimping tools	For cable terminals 1,5...240
16	Angle wrench	
17	Screw driver	
18	*Flat nose	7*2(mm)
19	*POZIDRIV	1, 2, 3
20	*Phillips	1, 2, 3
21	*Torx	25
22	Hexagonal wrench	4, 5, 6
23	ESD-protected place of work	Working surface, Floor covering, seat and ground connections
24	ESD-protective clothing	Wrist wrap, shoes, overall clothing (coat)

Item	Description	Details
25	Power supply (service)	Capacity of three phase service 400/500/690Vac, 30A
26	20-MAINSTD maintenance stand	Maintenance stand for removing power structure from drive cabinet
27	Fiber-optic repair kit	Agilent HFBR-4593 Polishing Kit, consisting of a Polishing Fixture, 600 grit abrasive paper and 3 mm pink lapping film (3M Company, OC3-14). For Agilent HFBR-4532 latching connectors and HFBR-RL cable. Refer to Agilent publications 5988-9777EN and 5988-3625EN.

Schematics

List of Schematic Diagrams

For a Schematic Diagram on...	See...
Phase U Power Circuitry for Drives with AC Input	page B-2
Phase V Power Circuitry for Drives with AC Input	page B-3
Phase W Power Circuitry for Drives with AC Input	page B-4
Phase U Power Circuitry for Drives with DC Input	page B-5
Phase V Power Circuitry for Drives with DC Input	page B-6
Phase W Power Circuitry for Drives with DC Input	page B-7
Circuit Board Connections for 700H Drives with AC Input	page B-8
Circuit Board Connections for 700H Drives with DC Input	page B-9
Circuit Board Connections for 700S Drives - Phase II Control with AC Input	page B-10
Circuit Board Connections for 700S Drives - Phase II Control with DC Input	page B-11
Fan Inverter and Main Fan Connections	page B-12

Power Wiring Diagrams

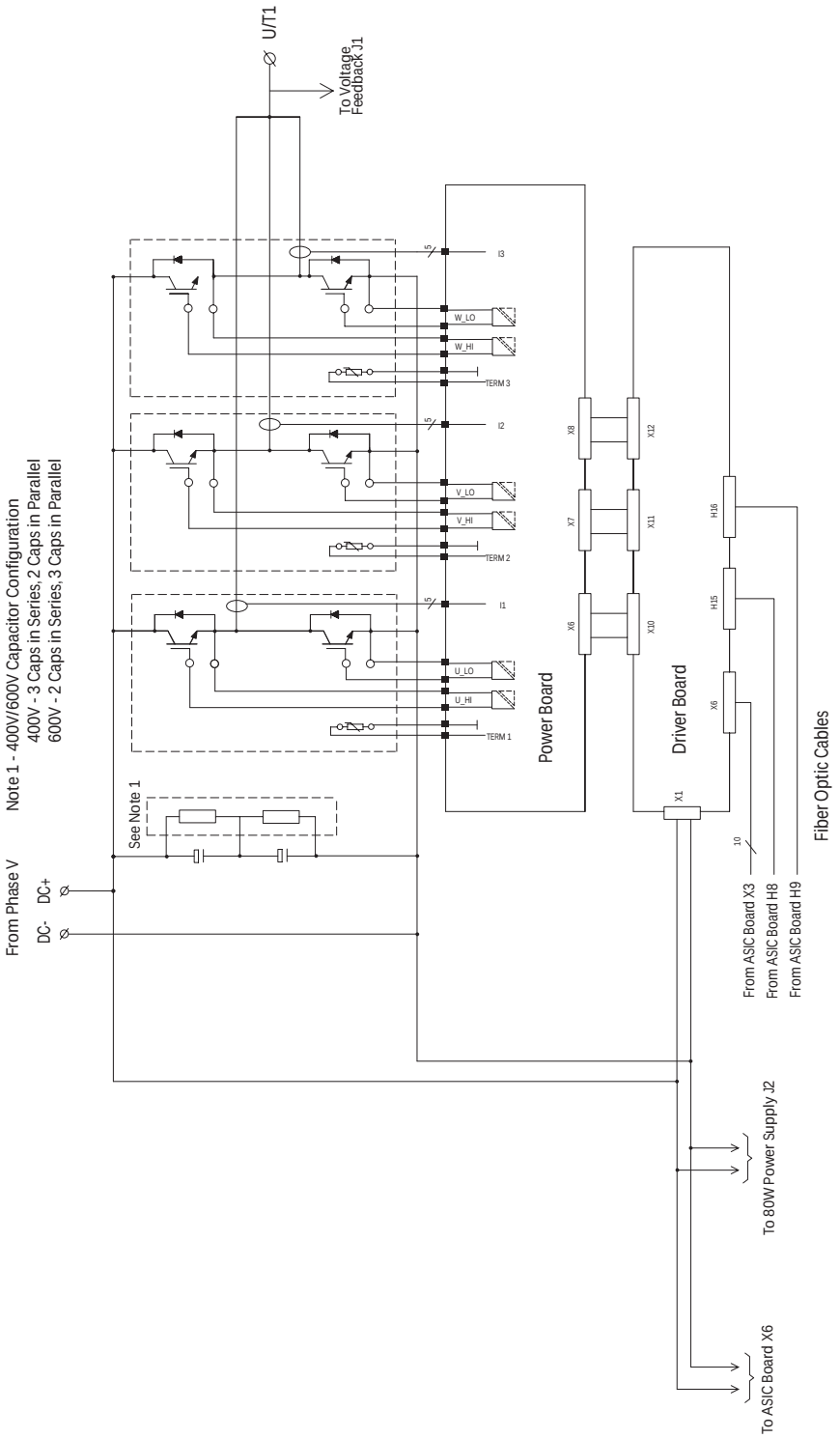


Figure B.1 Phase U Power Circuitry for Drives with AC Input

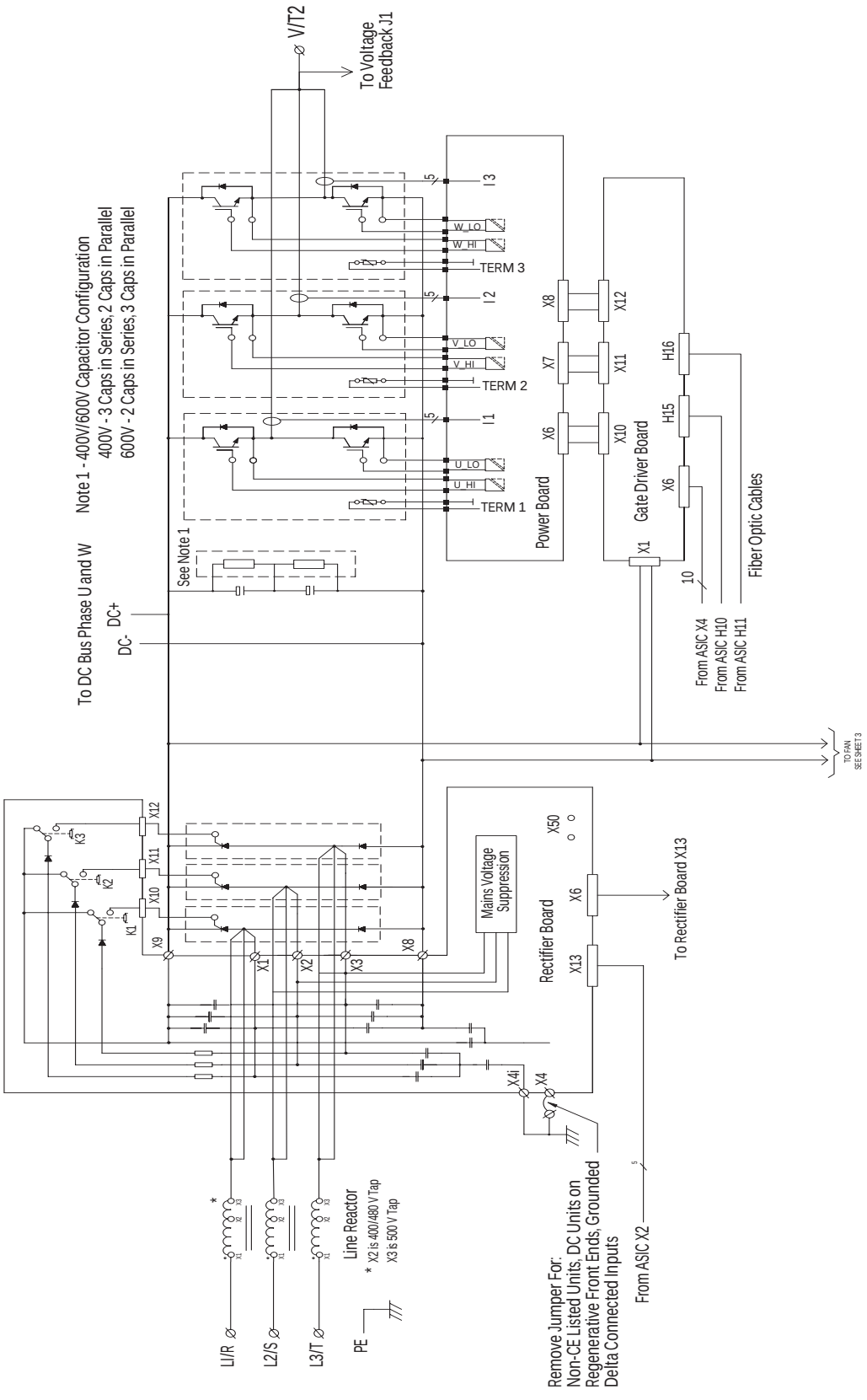


Figure B.2 Phase V Power Circuitry for Drives with AC Input

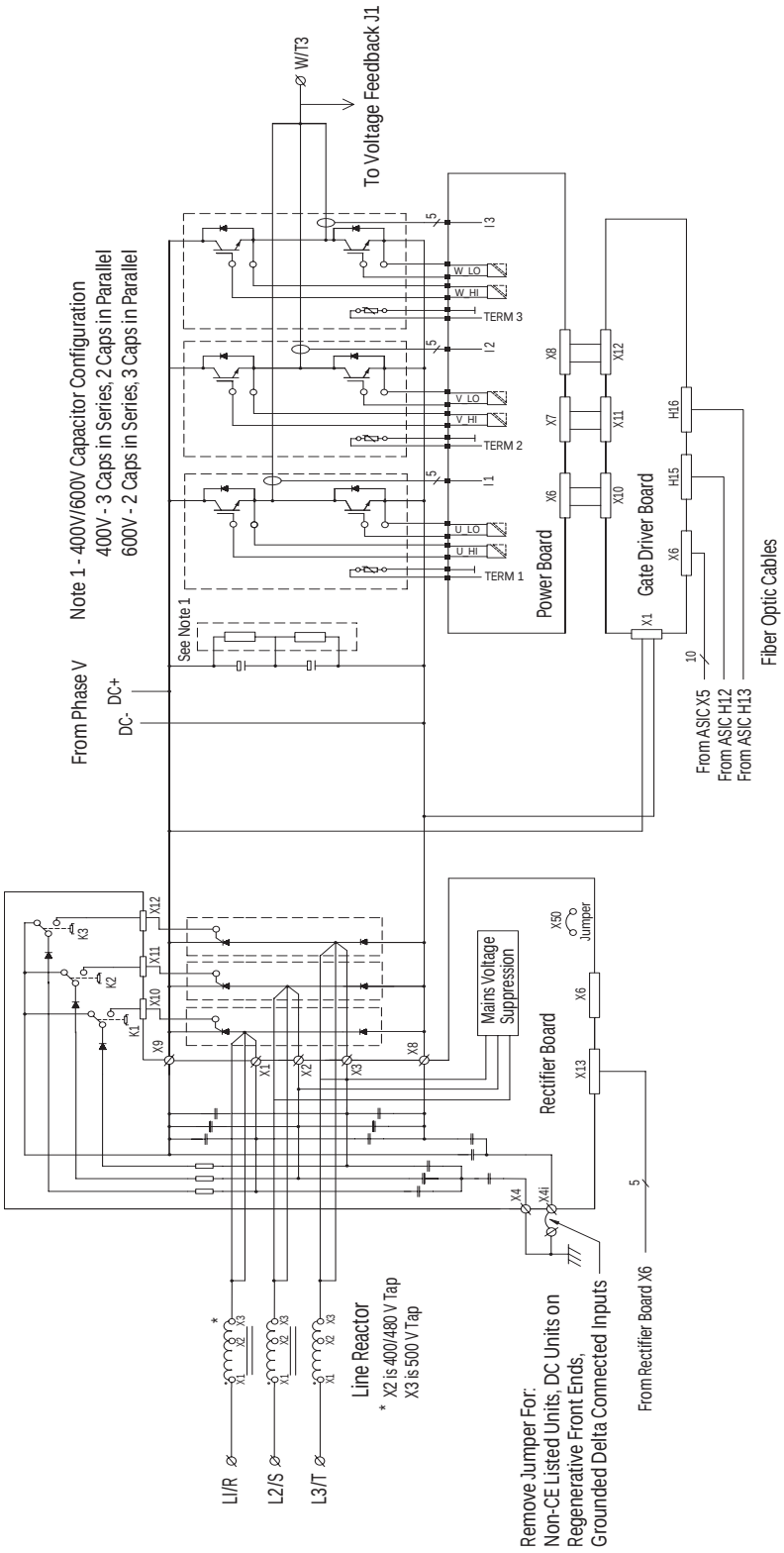


Figure B.3 Phase W Power Circuitry for Drives with AC Input

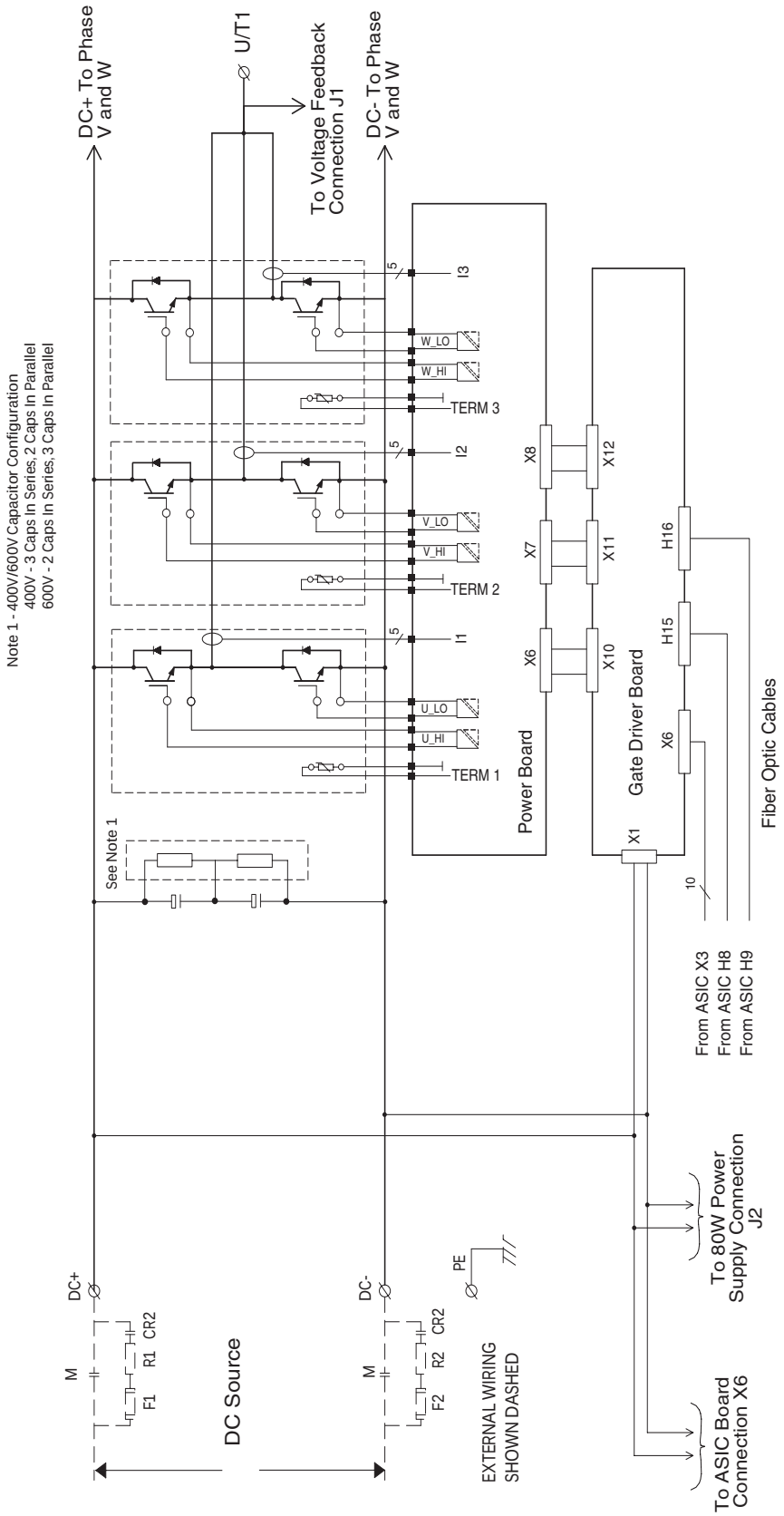


Figure B.4 Phase U Power Circuitry for Drives with DC Input

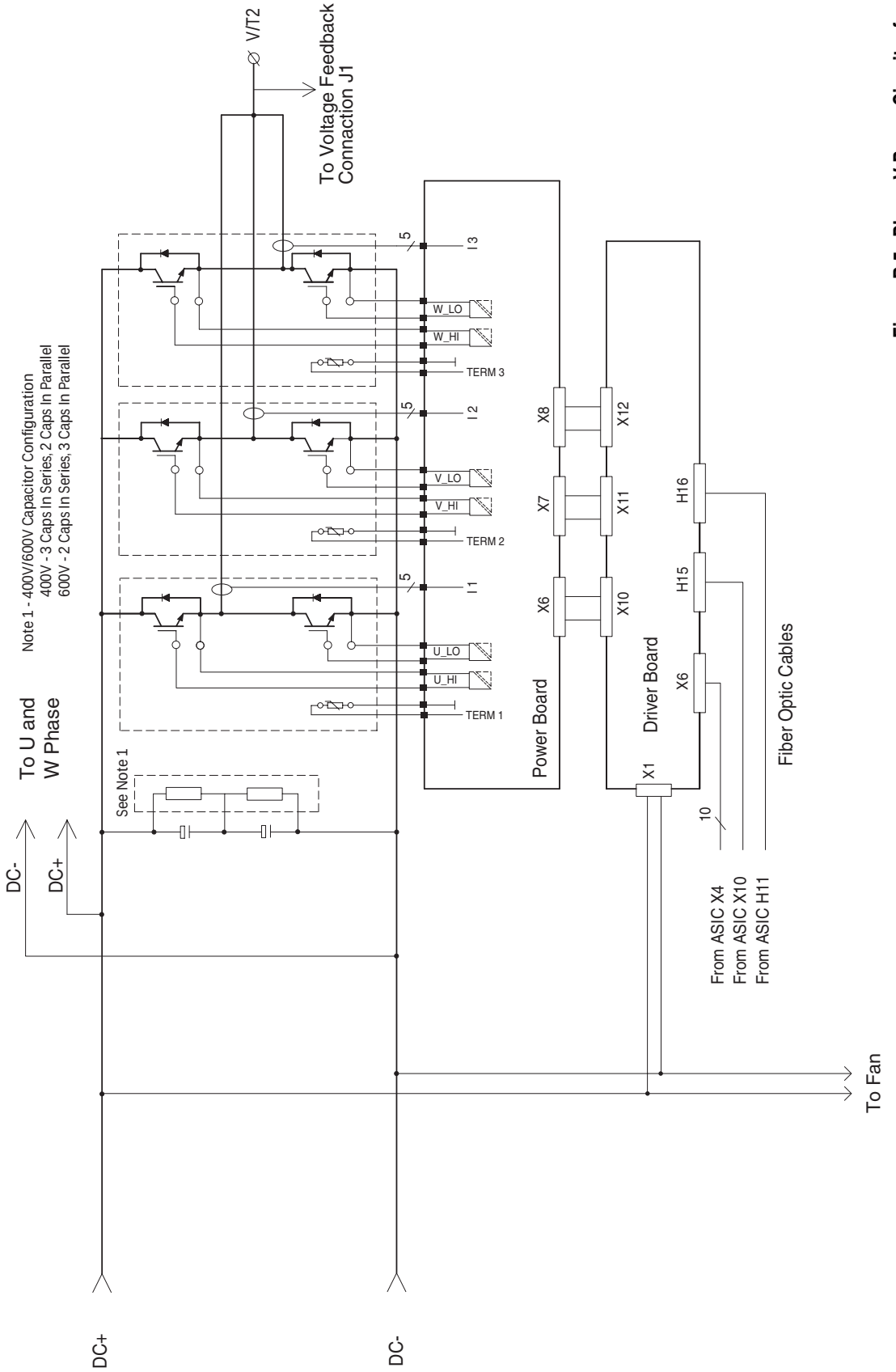


Figure B.5 Phase V Power Circuitry for Drives with DC Input

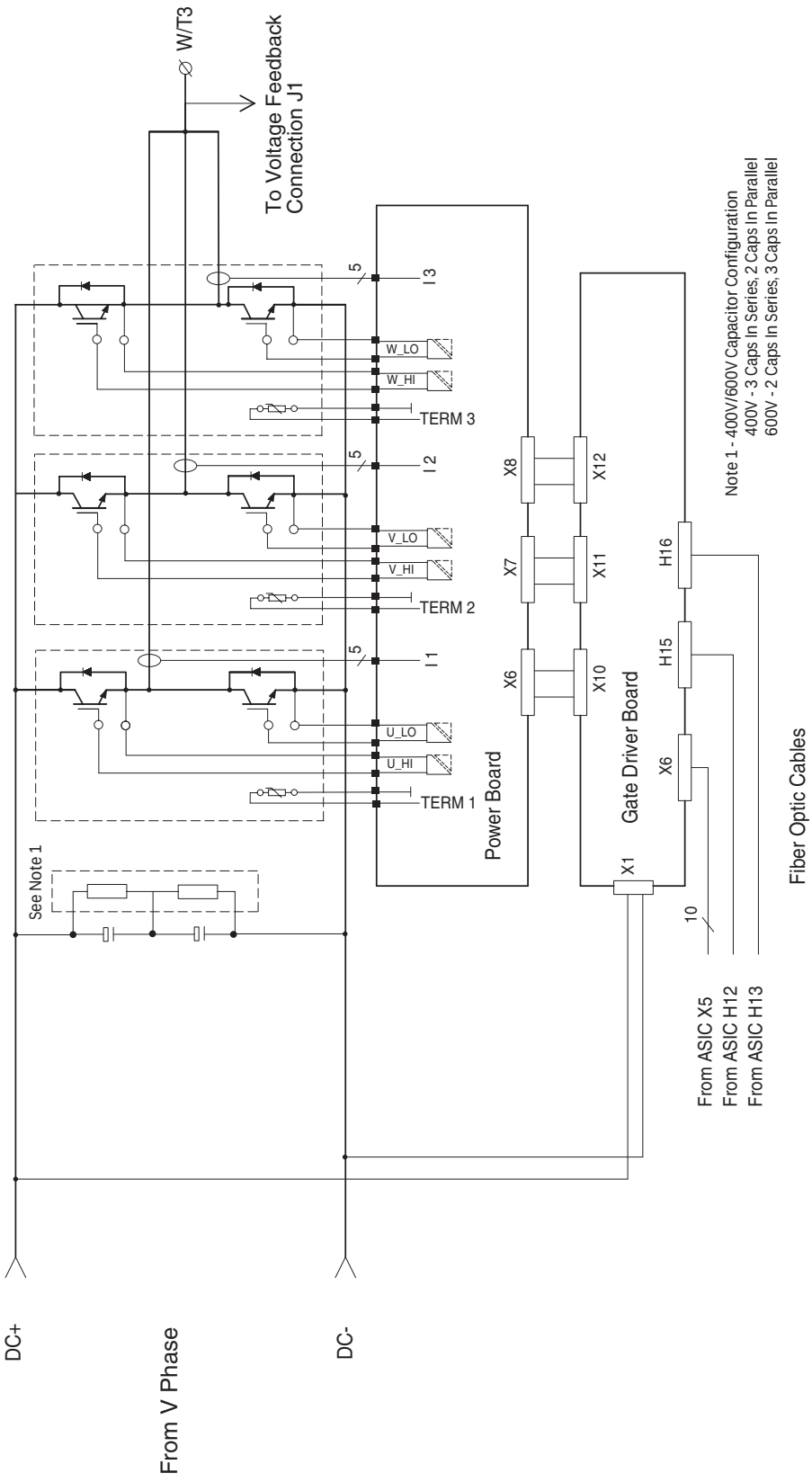


Figure B.6 Phase W Power Circuitry for Drives with DC Input

Control Wiring Diagrams

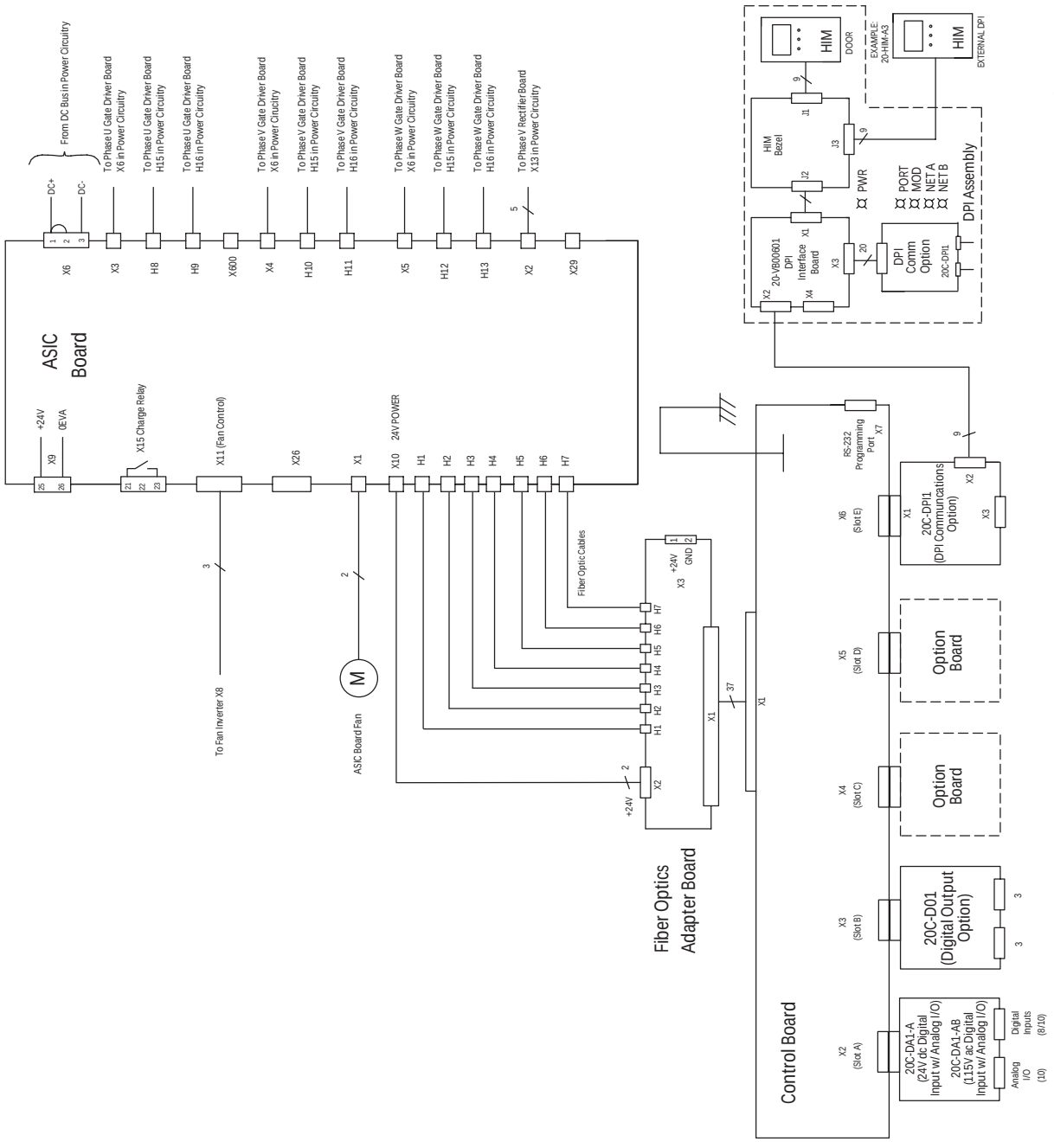


Figure B.7 Circuit Board Connections for 700H Drives with AC Input

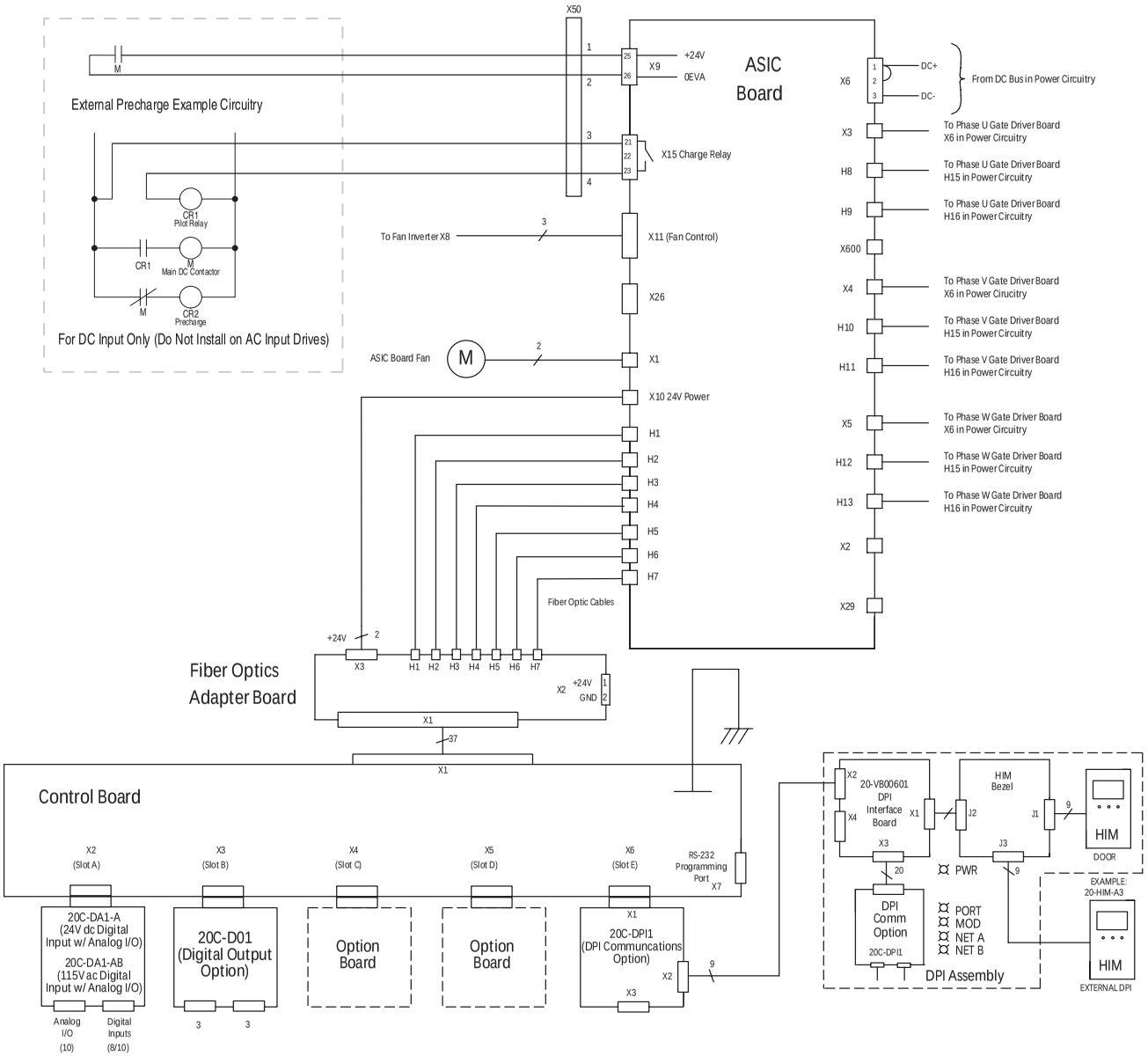


Figure B.8 Circuit Board Connections for 700H Drives with DC Input

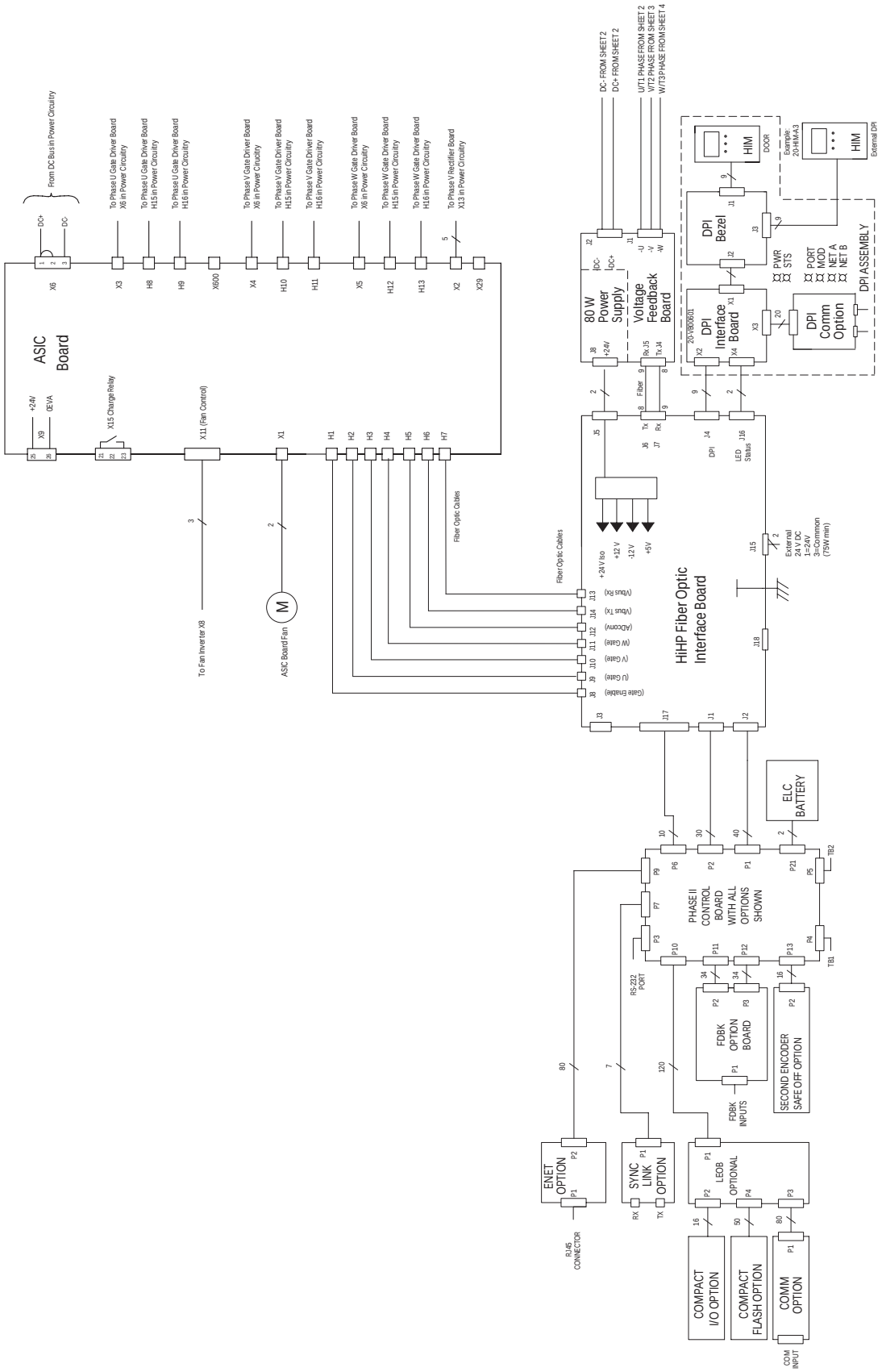


Figure B.9 Circuit Board Connections for 700S Drives - Phase II Control with AC Input

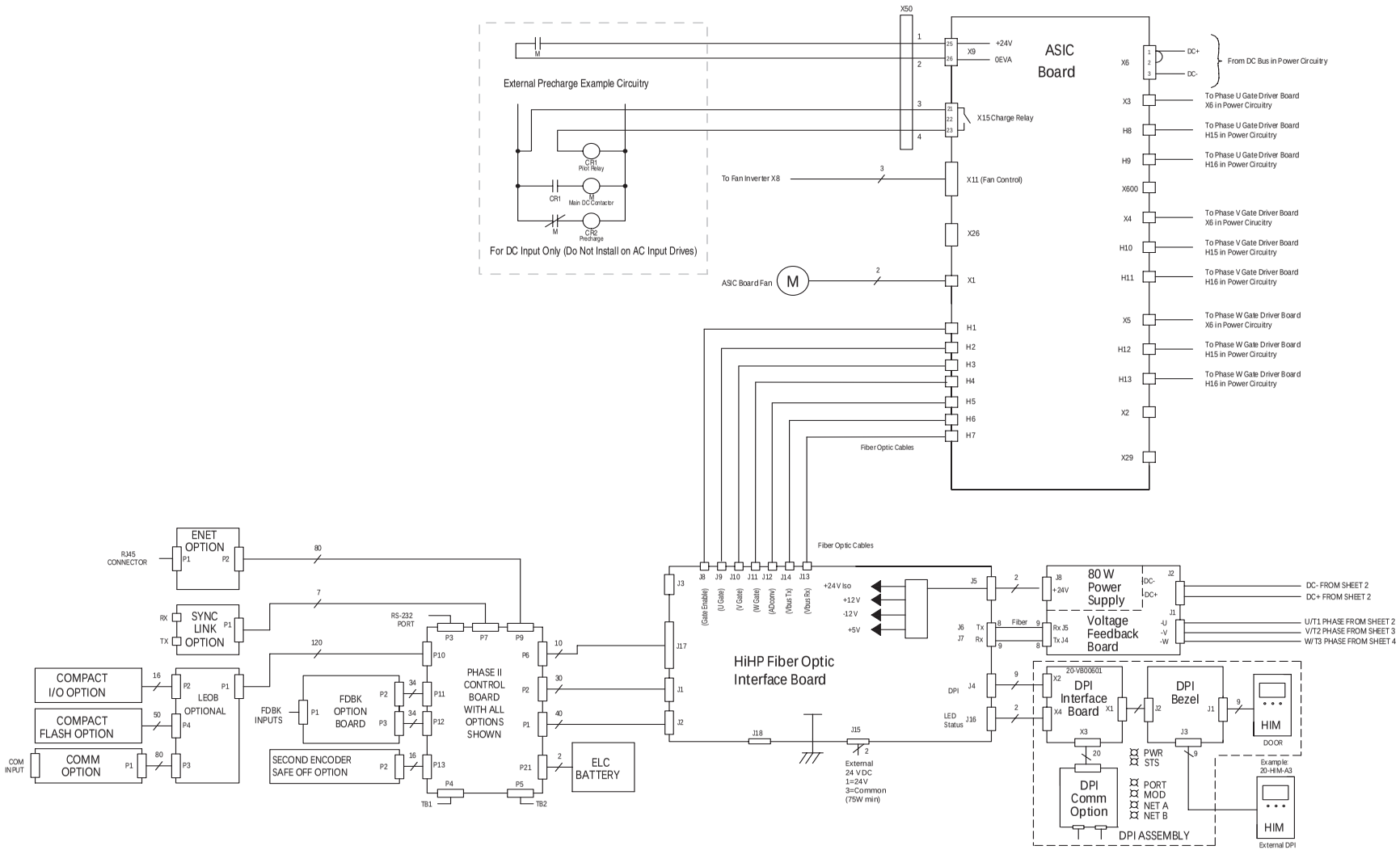


Figure B.10 Circuit Board Connections for 700S Drives - Phase II Control with DC Input

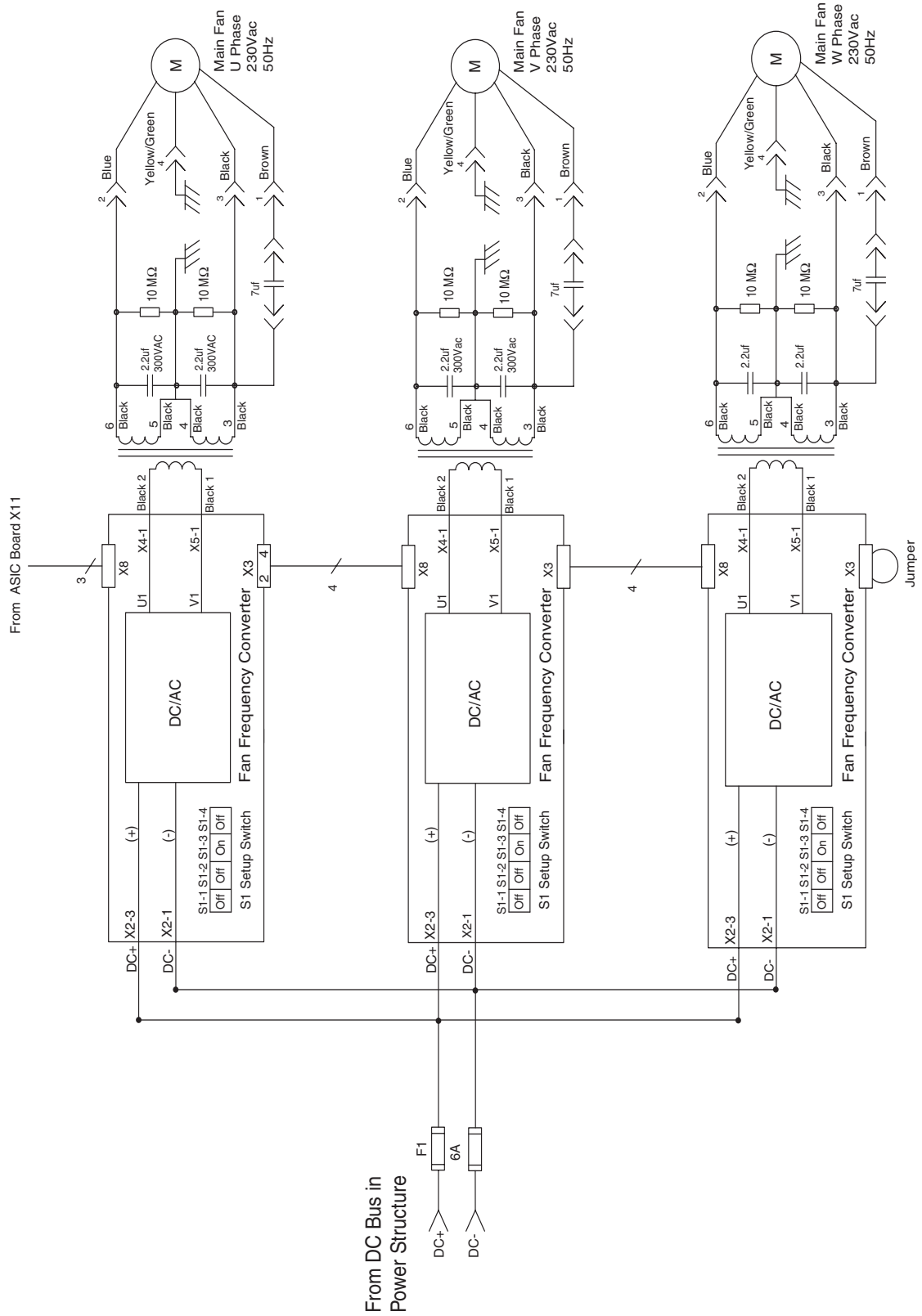


Figure B.11 Fan Inverter and Main Fan Connections

Connector Descriptions

For Information on...	See...
ASIC Board to Gate Driver Board Phase U Connections	page C-3
ASIC Board to Gate Driver Board Phase V Connections	page C-3
ASIC Board to Gate Driver Board Phase W Connections	page C-3
ASIC Board to Rectifier/Precharge Circuit Board Phase V Connections	page C-4
Rectifier/Precharge Circuit Board Phase V to Rectifier/Precharge Circuit Board Phase W Connections	page C-4
PowerFlex 700H Fiber Optic Adapter Circuit Board to ASIC Board Fiber Optic Connections	page C-5
PowerFlex 700S High Power Fiber Optic Interface Board to ASIC Board Fiber Optic Connections	page C-6
PowerFlex 700S High Power Fiber Optic Interface Board to Voltage Feedback Board Fiber Optic Connections	page C-6
ASIC Board to Main Cooling Fan Inverter Phase U Connections	page C-7
Main Cooling Fan Inverter Phase U to Main Cooling Fan Inverter Phase V Connections	page C-7
Main Cooling Fan Inverter Phase V to Main Cooling Fan Inverter Phase W Connections	page C-7
Main Cooling Fan Inverter Phase W Connections	page C-7
X50 Terminal Block Precharge Circuit Connections	page C-8

Circuit Board Connections

The following tables detail the connection points for the frame 11 PowerFlex 700S and 700H ac input drives circuit boards and components.

Figure C.1 ASIC Board Connectors

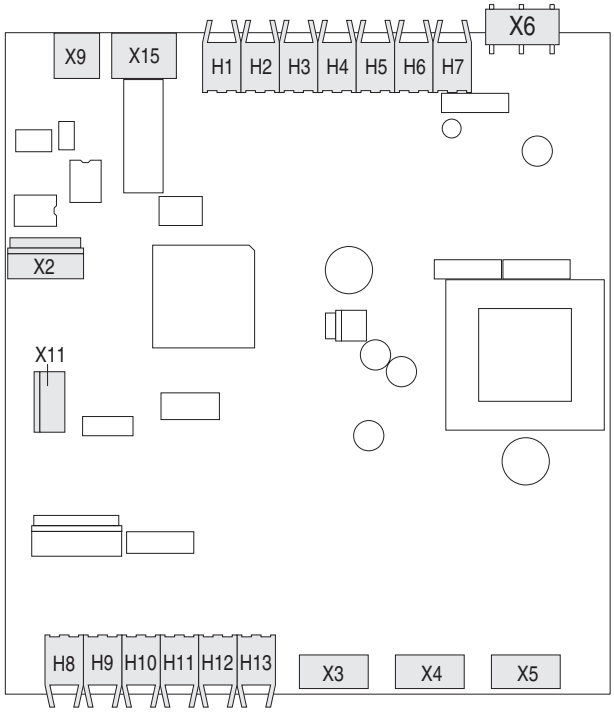


Figure C.2 Gate Driver Board Connectors

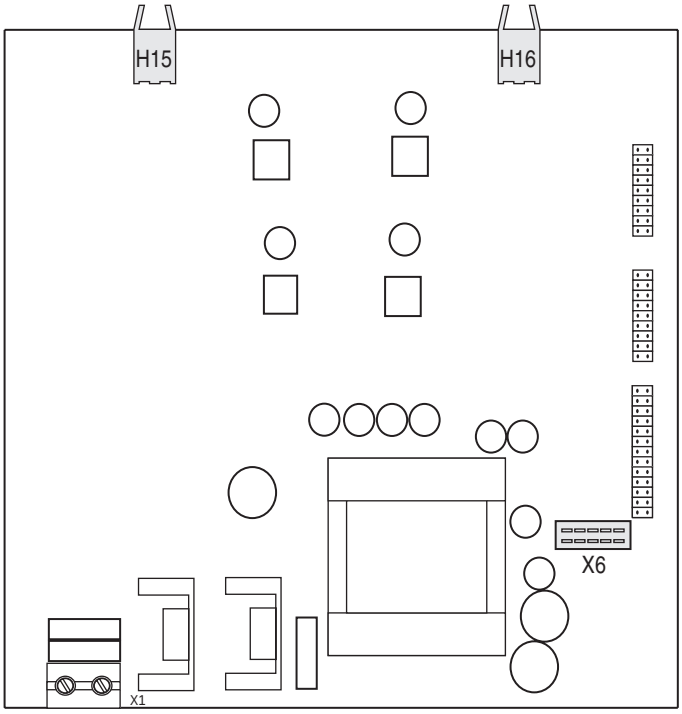


Table C.A ASIC Board to Gate Driver Board Phase U Connections

ASIC Board Connector	Pin Number	to	Pin Number	Gate Driver Board Connector	Description
X3	1	. . .	1	X6	U_Feedback
	2	. . .	2		U_Power_OK
	3	. . .	3		U_DTR(1) See Note Below
	4	. . .	4		U_ETR(2)
	5	. . .	5		U_ITR(3)
	6	. . .	6		U_DC-
	7	. . .	7		UI
	8	. . .	8		U_DC-_I
	9	. . .	9		U_TEMP
	10	. . .	10		U_DC-T
H8 (fiber optic)	H8	. . .	H15	H15 (fiber optic)	UH or Gate Top
H9 (fiber optic)	H9	. . .	H16	H16 (fiber optic)	UL or Gate Bottom

Note: See page C-3 for footnotes.

Table C.B ASIC Board to Gate Driver Board Phase V Connections

ASIC Board Connector	Pin Number	to	Pin Number	Gate Driver Board Connector	Description
X4	1	. . .	1	X6	V_Feedback
	2	. . .	2		V_Power_OK
	3	. . .	3		V_DTR(1)
	4	. . .	4		V_ETR(2)
	5	. . .	5		V_ITR(3)
	6	. . .	6		V_DC-
	7	. . .	7		VI
	8	. . .	8		V_DC-_I
	9	. . .	9		V_TEMP
	10	. . .	10		V_DC-T
H10 (fiber optic)	H10	. . .	H15	H15 (fiber optic)	VH or Gate Top
H11 (fiber optic)	H11	. . .	H16	H16 (fiber optic)	VL or Gate Bottom

Table C.C ASIC Board to Gate Driver Board Phase W Connections

ASIC Board Connector	Pin Number	to	Pin Number	Gate Driver Board Connector	Description
X5	1	. . .	1	X6	W_Feedback
	2	. . .	2		W_Power_OK
	3	. . .	3		W_DTR(1)
	4	. . .	4		W_ETR(2)
	5	. . .	5		W_ITR(3)
	6	. . .	6		W_DC-
	7	. . .	7		WI
	8	. . .	8		W_DC-_I
	9	. . .	9		W_TEMP
	10	. . .	10		W_DC-T
H12 (fiber optic)	H12	. . .	H15	H15 (fiber optic)	WH or Gate Top
H13 (fiber optic)	H13	. . .	H16	H16 (fiber optic)	WL or Gate Bottom

(1) DTR = N Desat

(2) ETR = Phase I2T

(3) ITR = Phase Overcurrent

Figure C.3 Rectifier/Precharge Circuit Board Connectors

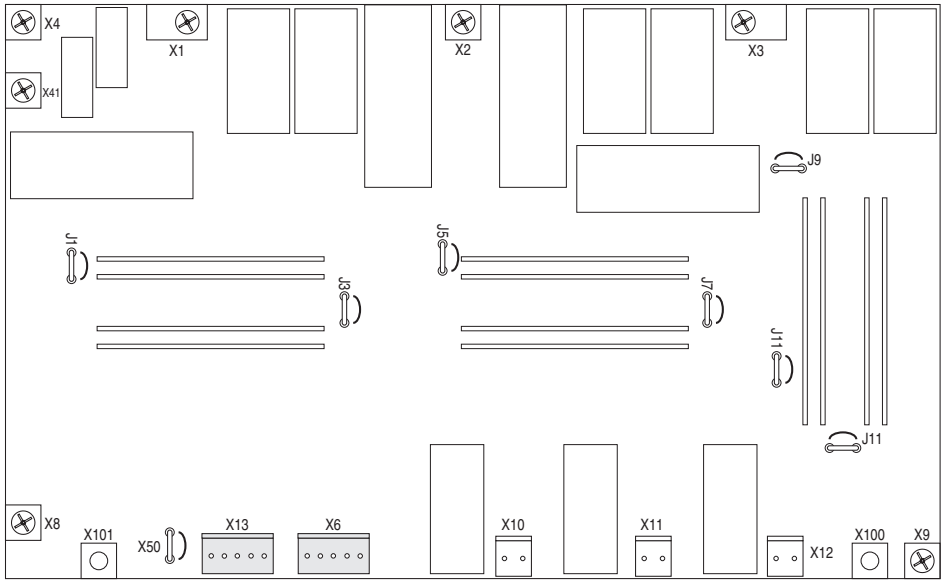


Table C.D ASIC Board to Rectifier/Precharge Circuit Board Phase V Connections

ASIC Board Connector	Pin Number	to	Pin Number	Rectifier Board Phase V Connector	Description
X2	1	. . .	1	X13	SWTS_DRV
	2	. . .	2		SWTS_FB
	3	. . .	3		DC -
	4	. . .	4		Mains Fault
	5	. . .	5		+24V

Table C.E Rectifier/Precharge Circuit Board Phase V to Rectifier/Precharge Circuit Board Phase W Connections

Rectifier Board Phase V Connector	Pin Number	to	Pin Number	Rectifier Board Phase W Connector	Description
X6	1	. . .	1	X13	SWTS_DRV
	2	. . .	2		SWTS_FB
	3	. . .	3		DC -
	4	. . .	4		Mains Fault
	5	. . .	5		+24V

Figure C.4 PowerFlex 700H Fiber Optic Adapter Circuit Board Connectors

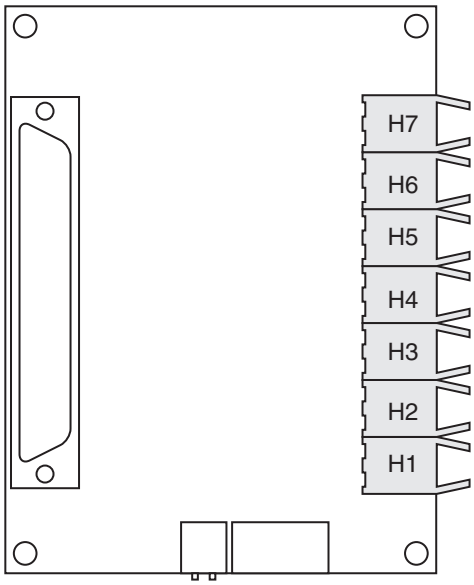


Table C.F PowerFlex 700H Fiber Optic Adapter Circuit Board to ASIC Board Fiber Optic Connections

Description	700H Interface Board Fiber Optic Connector	Type	to	Type	ASIC Board Fiber Connector (1)	Description
ENA Out	H1	TX	. . .	RX	H1	Gate_Enable
UH	H2	TX	. . .	RX	H2	U_Gate
VH	H3	TX	. . .	RX	H3	V_Gate
WH	H4	TX	. . .	RX	H4	W_Gate
A/D Convert	H5	TX	. . .	RX	H5	A/D Convert
VBUS_TX	H6	TX	. . .	RX	H6	VBUS_RX
VBUS_RX	H7	RX	. . .	TX	H7	VBUS_TX

(1) Refer to Figure C.1 on page C-2 for ASIC board fiber-optic connectors.

Figure C.5 PowerFlex 700S High Power Fiber Interface Circuit Board Connectors

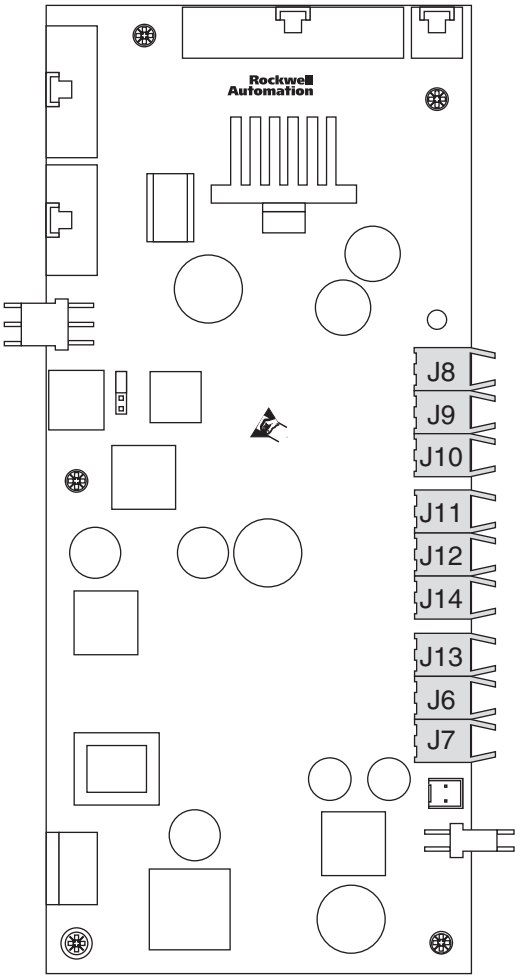


Table C.G PowerFlex 700S High Power Fiber Optic Interface Board to ASIC Board Fiber Optic Connections

Description	700SInterface Board Fiber Optic Connector	Type	to	Type	ASIC Board Fiber Connector (1)	Description
Gate_Enable	J8	TX	. . .	RX	H1	Gate_Enable
U_Post	J9	TX	. . .	RX	H2	U_Gate
V_Post	J10	TX	. . .	RX	H3	V_Gate
W_Post	J11	TX	. . .	RX	H4	W_Gate
A/D Convert	J12	TX	. . .	RX	H5	A/D Convert
VBUS_TX	J14	TX	. . .	RX	H6	VBUS_RX
VBUS_RX	J13	RX	. . .	TX	H7	VBUS_TX

(1) Refer to Figure C.1 on page C-2 for ASIC board fiber-optic connectors.

Table C.H PowerFlex 700S High Power Fiber Optic Interface Board to Voltage Feedback Board Fiber Optic Connections

Description	700SInterface Board Fiber Optic Connector	Type	to	Type	Voltage Feedback Board Connector	Description
TX	J6	TX	. . .	RX	J5	RX
RX	J7	RX	. . .	TX	J4	TX

Figure C.6 Fan Inverter Circuit Board Connectors

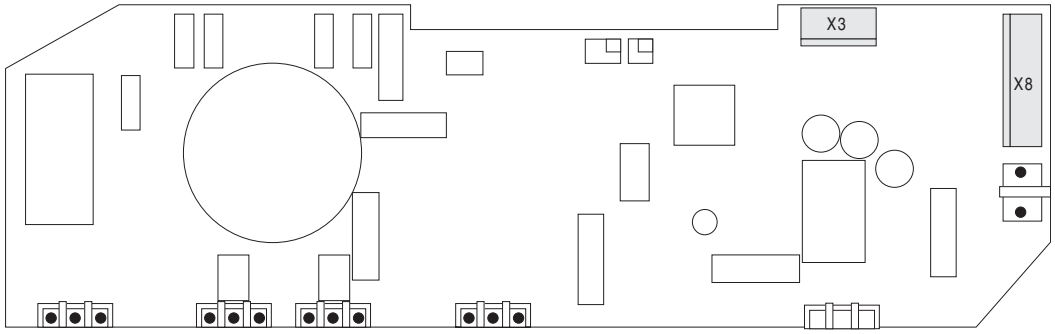


Table C.I ASIC Board to Main Cooling Fan Inverter Phase U Connections

Description	ASIC Board Connector(1)	Pin Number	Pin Number	Fan Inverter Connector	Description
+15V dc power to Fan Inverter boards	X11	2	2	X8	+15V dc power from ASIC board
Fan Control		3	3		Fan Control
Alarm from Fans		4	7		Fan Alarm to ASIC board

(1) Refer to Figure C.1 on page C-2 for ASIC board fiber-optic connectors.

Table C.J Main Cooling Fan Inverter Phase U to Main Cooling Fan Inverter Phase V Connections

Description	Fan Inverter Phase U Connector	Pin Number	Pin Number	Fan Inverter Phase V Connector	Description
+15V dc power	X3	2	2	X8	+15V dc power
Fan Control		3	3		Next Fan Control
Fan Alarm		4	7		Fan Alarm

Table C.K Main Cooling Fan Inverter Phase V to Main Cooling Fan Inverter Phase W Connections

Description	Fan Inverter Phase V Connector	Pin Number	Pin Number	Fan Inverter Phase W Connector	Description
+15V dc power	X3	2	2	X8	+15V dc power
Fan Control		3	3		Next Fan Control
Fan Alarm		4	7		Fan Alarm

Table C.L Main Cooling Fan Inverter Phase W Connections

Description	Fan Inverter Phase W Connector	Pin Number	Pin Number	Fan Inverter Phase W Connector	Description
+15V dc power	X3	2	4	X3	+15V dc power
Fan Alarm		4	2		Fan Alarm

Hardware Connections

Figure C.7 X50 Terminal Block Connectors

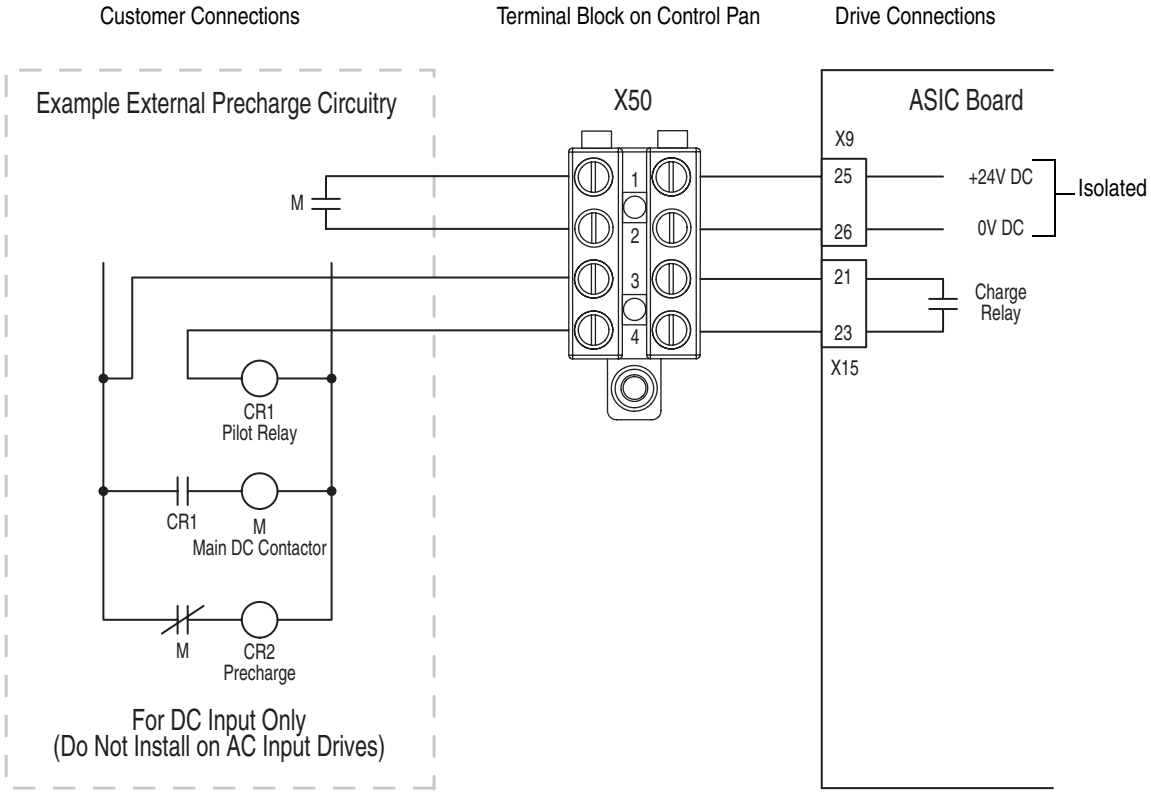


Table C.M X50 Terminal Block Precharge Circuit Connections

ASIC Board Connector	Terminal	to	X50 Terminal Block	Description
X9	25	. . .	1	Precharge Complete Signal
	26	. . .	2	Precharge Complete Signal
X15	21	. . .	3	Charge Relay Contact
	23	. . .	4	Charge Relay Contact

Disassembly / Assembly Diagrams

For a Diagram on...	See...
Main Power Structure Assembly	page D-2
Power Structure	page D-3
Phase U Power Structure Components	page D-4
Phase V and W Power Structure Components	page D-5
Fan Inverter	page D-6
ASIC Assembly	page D-7
Main Fan Assembly	page D-8

Disassembly/Assembly Diagrams and Spare Parts Numbers

Diagrams on the following pages illustrate disassembly and assembly of the drive and its sub-systems and are followed by a list of spare part numbers where applicable.

A complete list of spare parts for PowerFlex 700H/S drives is available on the Allen-Bradley web site at:
http://www.ab.com/support/abdrives/powerflex70/PF7ReleasedParts.pdf

Figure D.1 Main Power Structure Assembly

ATTENTION: The sheet metal cover and mounting screws on the ASIC Board located on the power structure are energized at (-) DC bus potential high voltage. Risk of electrical shock, injury, or death exists if someone comes into contact with the assembly.

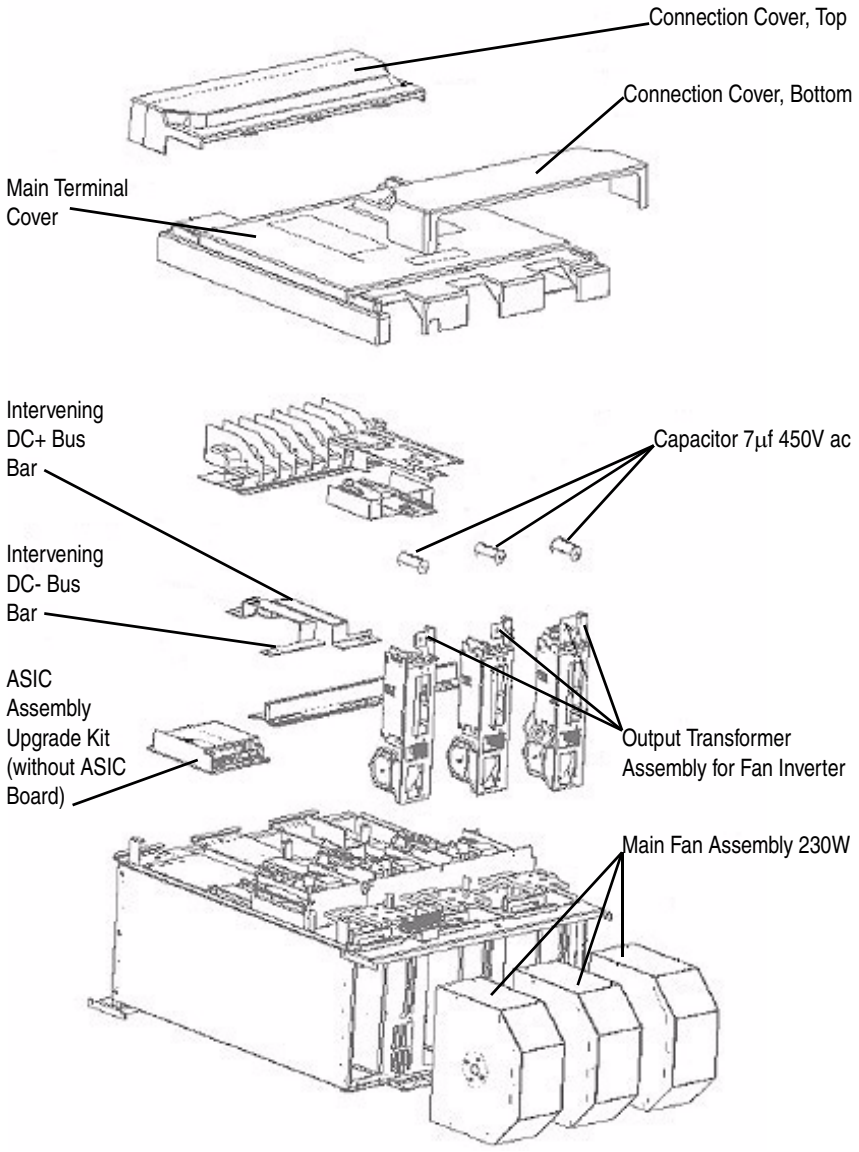


Table D.A Main Power Structure Assembly Part Numbers

Part Name	Spare Part No.
ASIC Assembly Upgrade Kit (without the ASIC Board)	NA
Capacitor 7µf 450V ac	20-PP00060
Connection Cover, Bottom	NA
Connection Cover, Top	NA
Intervening DC+ Bus Bar	NA
Intervening DC- Bus Bar	NA
Main Fan Assembly 230W	20-PP01080
Main Terminal Cover	NA
Output Transformer Assembly for Fan Inverter	20-FR10845

Figure D.2 Power Structure

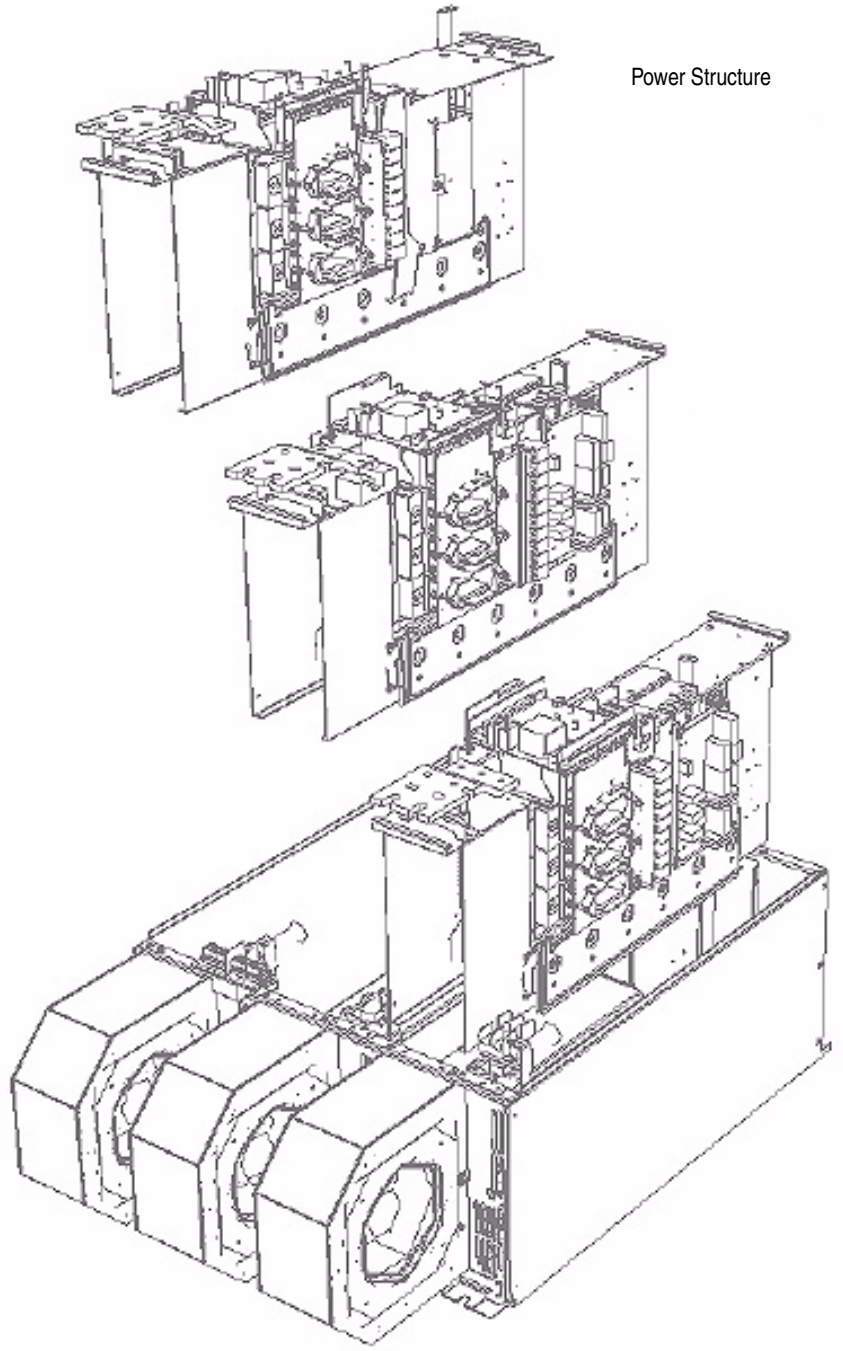


Table D.B Power Structure Part Numbers

Part Name	Rating	Spare Part No.
Power Structure	400/480V, 590A	SK-H1-PWRMOD-D590
	400/480V, 650A	SK-H1-PWRMOD-D650
	400/480V, 730A	SK-H1-PWRMOD-D730
	600/690V, 460A	SK-H1-PWRMOD-E460
	600/690V, 502A	SK-H1-PWRMOD-E502
	600/690V, 590A	SK-H1-PWRMOD-E590

Figure D.3 Phase U Power Structure Components

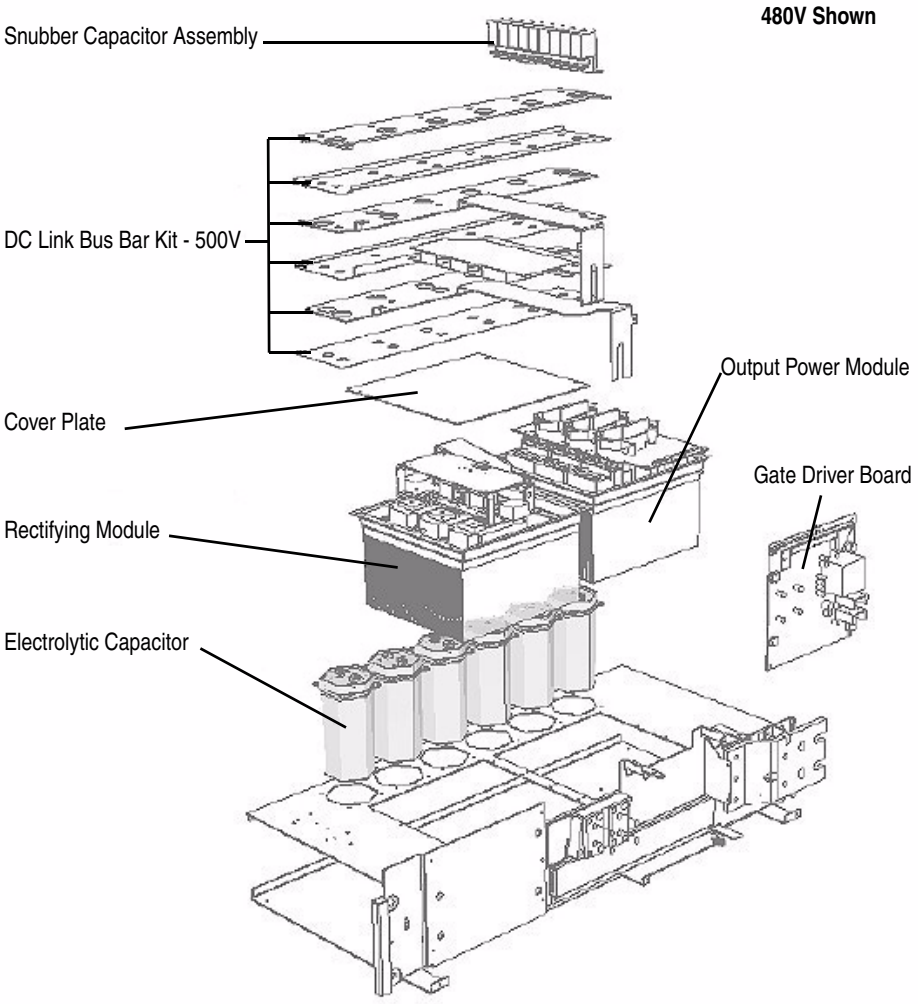


Table D.C Phase U Power Structure Components Part Numbers

Part Name		Spare Part No.
Cover Plate		NA
DC Link Bus Bar Kit	500V	NA
	690V	NA
Electrolytic Capacitor	ELKO 3300μf 420V Bus Capacitor - 400/480V	20-PP01005
	ELKO 5600μf 420V Bus Capacitor - 600/690V	20-PP01099
Snubber Capacitor Assembly		20-PP10019
Gate Driver Board -	480V	SK-H1-GDB1-F11D
	690V	SK-H1-GDB1-F11E
Output Power Module	400/480V	SK-H1-QOUT-D590
	400/480V	SK-H1-QOUT-D650
	400/480V	SK-H1-QOUT-D730
	600/690V	SK-H1-QOUT-E460
	600/690V	SK-H1-QOUT-E502
	600/690V	SK-H1-QOUT-E590
Rectifying Module	400/480V	20-FR10820
	600/690V	20-FR10821

Figure D.4 Phase V and W Power Structure Components

480V Shown

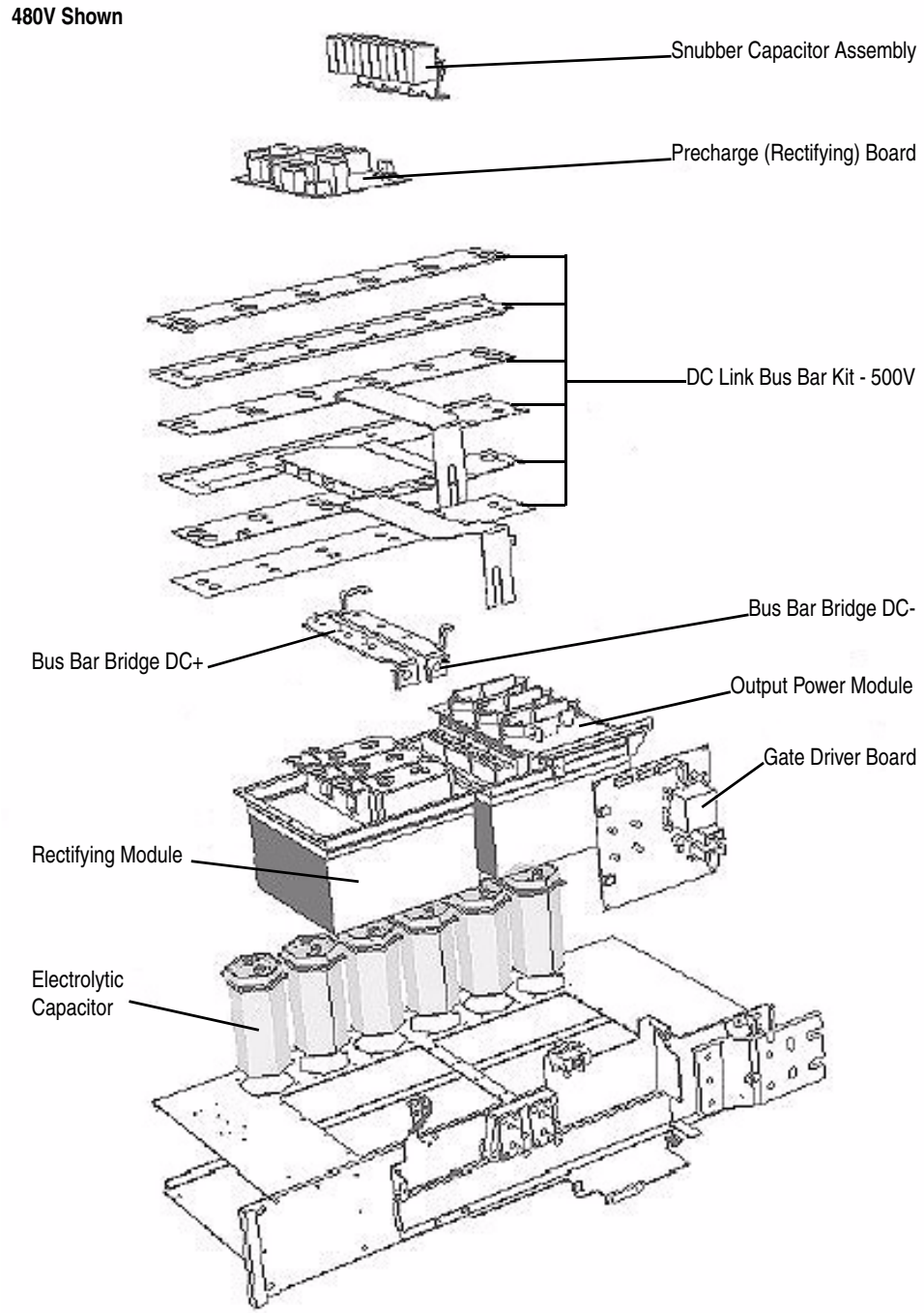


Table D.D Phase V and W Power Structure Components Part Numbers

Part Name		Spare Part No.
Cover Plate		NA
DC Link Bus Bar Kit	500V	NA
	690V	NA
Electrolytic Capacitor	ELKO 3300µf 420V Bus Capacitor - 400/480V	20-PP01005
	ELKO 5600µf 420V Bus Capacitor - 600/690V	20-PP01099
Snubber Capacitor Assembly		20-PP10019
Gate Driver Board -	480V	SK-H1-GDB1-F11D
	690V	SK-H1-GDB1-F11E

Part Name		Spare Part No.
Output Power Module	400/480V	SK-H1-QOUT-D590
	400/480V	SK-H1-QOUT-D650
	400/480V	SK-H1-QOUT-D730
	600/690V	SK-H1-QOUT-E460
	600/690V	SK-H1-QOUT-E502
	600/690V	SK-H1-QOUT-E590
Rectifying Module	400/480V	20-FR10820
	600/690V	20-FR10821

Figure D.5 Fan Inverter

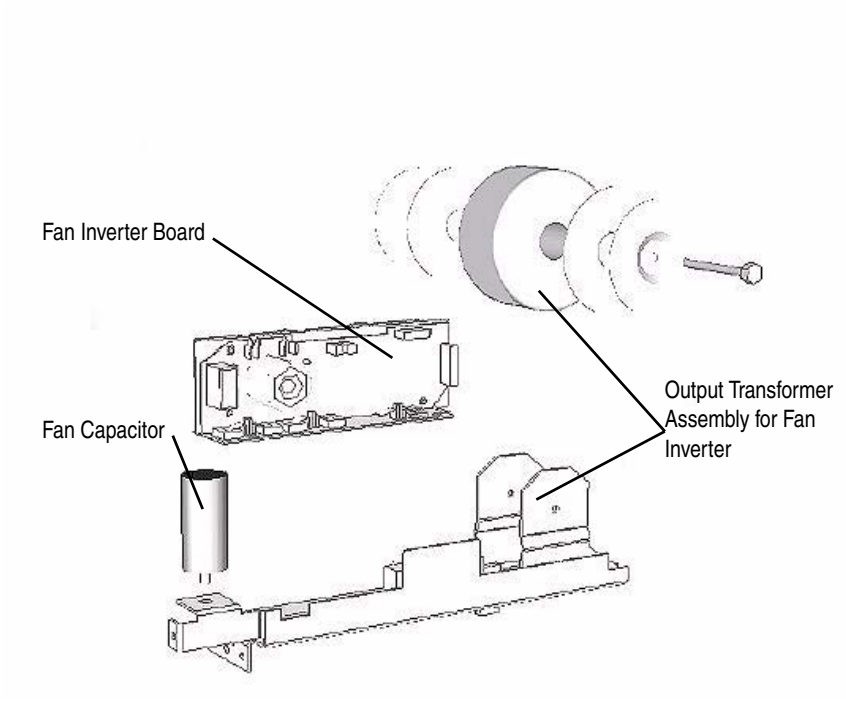


Table D.E Fan Inverter Part Numbers

Part Name	Spare Part No.
Fan Capacitor 7μf 450V ac	20-PP00060
Fan Inverter Board	20-VB00299
Output Transformer Assembly for Fan Inverter	20-FR10845

Figure D.6 ASIC Assembly

ATTENTION: The sheet metal cover and mounting screws on the ASIC Board located on the power structure are energized at (-) DC bus potential high voltage. Risk of electrical shock, injury, or death exists if someone comes into contact with the assembly.

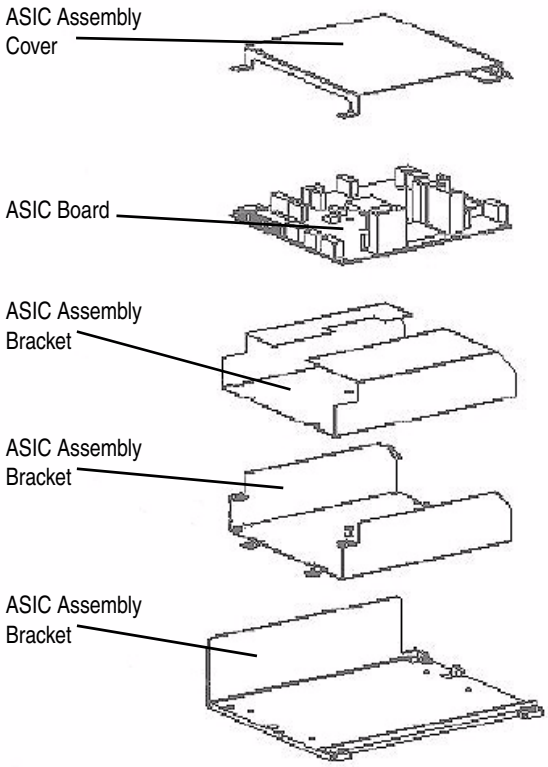


Table D.F ASIC Assembly Part Numbers

Part Name		Spare Part No.
ASIC Assembly Bracket		NA
ASIC Assembly Bracket		NA
ASIC Assembly Bracket		NA
ASIC Assembly Cover		NA
ASIC Board	400/480V, 590A	SK-H1ASICBD-D590
	400/480V, 650A	SK-H1ASICBD-D650
	400/480V, 730A	SK-H1ASICBD-D730
	600/690V, 460A	SK-H1ASICBD-E460
	600/690V, 502A	SK-H1ASICBD-E502
	600/690V, 590A	SK-H1ASICBD-E590

Figure D.7 Main Fan Assembly

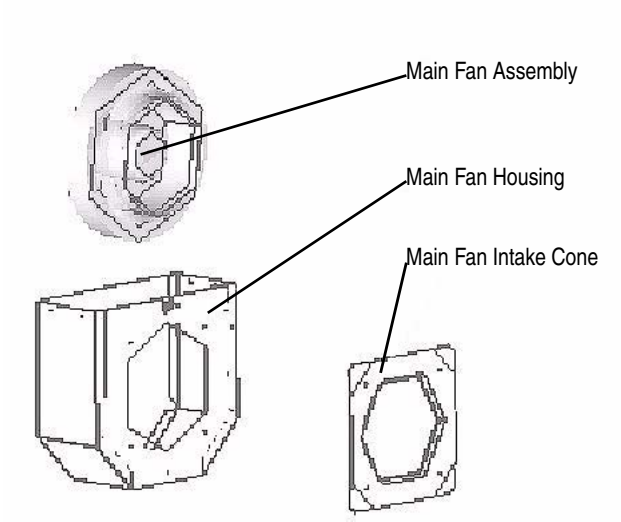


Table D.G Main Fan Assembly Part Numbers

Part Name	Spare Part No.
Main Fan Assembly 230W	20-PP01080
Main Fan Housing	NA
Main Fan Intake Cone	NA

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Publication PFLEX-TG003A-EN-P – March 2006

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